ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

BACKGROUND

The alternatives in this document are intended to establish broad management guidelines. The general nature of the alternatives requires that the analysis of impacts also be general. This means that the National Park Service can make reasonable projections of likely impacts, but these are based on assumptions that may prove not to be accurate in the future.

As a result, this *General Management Plan / Environmental Impact Statement* is programmatic, presenting an overview of the potential impacts relating to each alternative. It will serve as a basis for NEPA documents prepared to assess subsequent developments or management actions. If and when specific NPS development or other actions are proposed as a result of this *General Management Plan / Environmental Impact Statement* for Coronado National Memorial, NPS staff will determine whether more detailed environmental documentation is needed, consistent with the provisions of the National Environmental Policy Act.

Following this introduction, the methodology used in the environmental impact analysis is presented. The impact analysis sections are organized by alternative. The first analyzed is alternative A (the no-action or existing management direction alternative), followed by the "action" alternatives B, C, D, and E. The potential effects on natural resources are discussed, followed by the effects on cultural resources, visitor understanding, and the socioeconomic environment. Each discussion includes cumulative effects and conclusions. The environmental effects are compared in table 9, page 77.

CUMULATIVE EFFECTS

Definition

A cumulative effect is described in the regulations of the Council on Environmental Quality (CEQ), which implement the National Environmental Policy Act of 1969 (42 USC 4321 *et seq.*). The CEQ regulations require that cumulative effects be assessed in the decision-making process for federal projects and that there be a description of how the cumulative effects for a particular project were determined. A cumulative impact is defined in regulation 1508.7 as follows:

> A "cumulative impact" is the impact on the environment which results from the incremental impact on the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Plans Considered for Cumulative Effects Analysis

It was necessary to identify other ongoing or reasonably foreseeable future projects at Coronado National Memorial and in the surrounding region. The region, or assessment area, covers Cochise County, Coronado National Forest, and the San Pedro National Conservation Area. Projects were identified through correspondence, Internet sites, and meetings with county and city governments and with other federal land managers. Any planning or development activity that is being implemented or will be implemented in the reasonably foreseeable future was considered a cumulative action. The plans considered are described below.

Livestock Management Plan (NPS 2000b). Since their arrival in the 1500s, livestock made a significant impact on the natural landscape of southeastern Arizona, particularly during the late 1800s and early 1900s. Improper livestock management stripped the grasslands of their vegetation, increased woody plant production, caused massive arroyo cutting, and facilitated soil erosion (Hastings and Turner 1965).

A major drought in the late 1800s reduced livestock numbers by 50%–75% and contributed to the degradation of native vegetation. Coronado National Forest was established in the early 1900s, making available for the first time the means to manage livestock use on public lands. Allotments were established and fenced. Permits generally were issued to the ranchers who had traditionally used the areas.

The National Park Service will work toward permanently retiring the remaining grazing allotments in the national memorial as opportunities arise to do so through mutual agreement with the permittees. Until this can be accomplished, this plan will serve to moderate the effects of grazing. The proposal, as described in the *Finding of No Significant Impact* (NPS n.d.) has intensified grazing management. The four key components of the plan include (a) reducing animal unit months so that impacts on native vegetation will be more moderate, (b) adjusting the season of use to avoid grazing during vegetative growing seasons, (c) implementing a comprehensive vegetation monitoring plan, and (d) providing flexibility of use in both the number of animal unit months and the season of use, based on environmental indicators. All costs incurred by the National Park Service in managing this special use are being billed to the permittee.

Coronado National Forest, Land and Resource Management Plan **(Forest Service, USDA 1986).** The forest lies on the north and west sides of Coronado National Memorial. Its most recent forest plan contains the following major points:

- Equalize permitted grazing use and range carrying capacity within 10 to 15 years, and improve rangeland conditions.
- Improve forest-wide watershed conditions.
- Improve the condition of riparian habitats and increase their productivity.
- Recommend the addition of 62,000 acres to the wilderness system, and provide for a higher quality of recreational experience.
- Improve the developed recreational experience by increasing coordination with other agencies and the private sector in constructing new recreation sites, rehabilitating existing recreation sites, and implementing capacity controls.
- Enhance dispersed recreation experiences with improved public access and designation of zoological-botanical areas.
- Limit motorized vehicle use to designated trails and roads.
- Promote the conservation of state and federally listed threatened and endangered species.
- Improve fish and wildlife habitats by balancing successional stages of vegetation through commercial timber sales, fuelwood harvest, prescribed burning, coordination with other resource activities, and direct habitat improvement.
- Provide a balance between the production of commodities such as wood products, developed recreation opportunities, livestock grazing, mineral production, and the protection of amenities such as scenic quality, wildlife habitat, diversity, riparian condition, wilderness opportunity, watershed condition, and dispersed recreation opportunities.

In addition to the actions in the plan, the Forest Service is constructing a trail system along the eastern side of the Huachuca Mountains that may eventually connect to the

memorial's boundary near its northeast corner.

***East Huachucas Strategy Draft* (Forest Service, USDA 1997).** This plan of the Sierra Vista Ranger District, Coronado National Forest focuses on the east side of the Huachucas from the crest of the mountains on the west to the Coronado National Forest boundary on the east. The area, which is bounded on the north and northwest by Fort Huachuca and on the south by Coronado National Memorial, covers 22,000 acres, of which 12,000 acres (roughly the western half) is the congressionally designated Miller Peak Wilderness Area. The wilderness area is managed with a preservation philosophy rather than the multiple resource use policy of nonwilderness forestlands. This plan identifies actions needed to improve recreation and resource conditions on the remaining 10,000 nonwilderness acres. In its stewardship of this area, the U.S. Forest Service has the following goals for the future of recreation and resource integrity:

- Management emphasis for the east side of the Huachucas will focus on maintaining and improving biological diversity and providing high quality recreational experiences.
- Scenic and historic settings will be preserved.
- Urbanization around the foothills of the east Huachucas requires planning and management that includes consideration of biological, sociological, and economic needs.
- Future planning and management must recognize and adhere to the boundaries set in this plan for scales of development so that the desired habitat and recreation settings are maintained for future generations.

The following are examples of plan actions:

- New facilities will be rural or semiprimitive in character.
- Construct a low elevation trail that connects the various existing canyon trails. This "perimeter" trail would provide loop trail opportunities for hiking, horseback riding, and mountain biking.
- Define and delineate low elevation camping and picnicking areas.
- Protect existing wildlife corridors from the mountain range to the adjacent land during future planning and management.
- Work with officials from Fort Huachuca to provide legal trail access from the fort to the forest and vice versa. This would open extensive trail opportunities to the public.

The Final Safford District Resource Management Plan and Environmental Impact Statement (BLM 1990b). This plan of the Safford District, Bureau of Land Management, describes and analyzes alternative plans for managing about 1.4 million acres of public land in southeastern Arizona. It covers all BLM-managed land in Graham, Greenlee, and Cochise Counties and portions of Pinal, Pima, and Gila Counties.

The selected plan, alternative A, will guide the management of the lands for 15 years. The preferred alternative provides a balanced approach to multiple use management and will protect sensitive resources that cannot tolerate disturbance from other activities. It also provides for the consumptive use and development of other resources, as follows:

- Three research natural areas of critical environmental concern will be designated as recommended in the *San Pedro River Riparian Management Plan and Final Environmental Impact Statement* (BLM 1989). Management plans will be prepared for each area after designation.
- Portions of the Gila and San Francisco Rivers have been recommended by the National Park Service for further study as potential candidates for designation under the Wild and Scenic Rivers Act. Suitability

determinations will be prepared at a later date.

- The *Arizona Wetland Riparian Management Strategy* (BLM 1990a) has as a primary goal "to improve water quality and riparian areas to good or better ecological conditions by 1997 for 75 percent of BLM-administered streams by implementing grazing systems and strategically planned enhancement projects." The following are examples of how BLM policies support the implementation of this goal.
  - ✓ Achieve riparian area management and maintenance objectives through the management of existing uses wherever feasible.
  - ✓ Prescribe the management of riparian values based on site-specific characteristics and settings.
  - ✓ Give special attention to monitoring and evaluating management activities in riparian areas, and revise management practices where site-specific objectives are not being met.
  - ✓ Identify, encourage, and support research and studies needed to ensure that riparian area management objectives can be properly defined and met.
- The Safford plan's goal for the management of riparian areas is to maintain or improve 75% of the acreage of riparian vegetation on public lands within the district in good or excellent condition by 1997.
- The Bureau of Land Management's goal is to minimize soil erosion and rehabilitate eroded areas to maintain and enhance watershed condition and reduce nonpoint source pollution that can result from rangeland management and use activities. The Safford plan contains specific actions to address soil erosion and salinity management.
- As required by law, the Bureau of Land Management will manage vegetation for its use while maintaining sufficient ground cover to maintain and enhance watershed condition and reduce nonpoint source pollution from range land management and use activities.
- The Bureau of Land Management will designate 13 areas of critical environmental concern totaling 40,805 acres (31,949 acres of public land) to protect important natural and cultural resources.
- The plan includes developing coordinated resource management plans to direct multiple use programs on public lands in the Aravaipa Creek Watershed, Muleshoe Ranch, and Bear Springs Flat areas to direct the development of program activities toward the maintenance and enhancement of watershed condition.
- The plan also includes managing cultural resources for information potential, public values, and conservation.

San Pedro River Riparian Management Plan and Final Environmental Impact Statement. (BLM 1989). The San Pedro riparian area, administered by the Bureau of Land Management, contains about 40 miles of the upper San Pedro River extending from several miles south of Saint David to the border with Mexico. It was designated by Congress as a national conservation area on November 18, 1988. From the eastern boundary of the Coronado National Memorial, the closest part of the national conservation area is about 10 miles to the east. This area was set aside to protect and enhance the riparian ecosystem and related resources.

The plan notes four areas of the San Pedro that are potential areas of critical environmental concern: San Pedro Riparian, St. David Cienega, San Pedro River, and San Rafael.

The proposed action of the San Pedro River plan will permit developed sites outside the

riparian areas to the extent of four large sites and seven small ones. Overnight camping by permit will be allowed. The proposed action emphasizes actions to protect or enhance vegetation, wildlife habitat, water, and cultural/paleontological resources. Livestock grazing on the original acreage has been prohibited for the life of the plan.

Upper San Pedro Partnership. This group is a consortium of local, state, and federal agencies (including the National Park Service), organizations, and landowners whose goal, according to its brochure, is to "ensure that a long-term groundwater supply is available to meet the needs of current and future residents and the San Pedro Riparian National Conservation Area." The three strategies of the partnership are to do the following:

- Reduce water consumption to the minimum necessary to meet the needs of people and nature.
- Reclaim used water (effluent) that would otherwise be wasted.
- Augment existing water resources through improved rainfall harvesting techniques.

Southern San Pedro Valley Area Plan, Public Review Draft (2001). The goal of this plan, (produced by the Southern San Pedro Valley Area Plan Citizen Planning Committee, Cochise County Planning and Management Information Systems Staff, Cochise County Planning Commission, and Cochise County Board of Supervisors) is to provide guidelines for the future development of land use in the plan area. The boundaries of the Palominas Fire District are the boundaries of the plan. This plan and land use map will be amendments of Cochise County's comprehensive plan.

At the beginning of the planning process, more than 1,200 surveys were mailed to property owners in the planning area. Most of the responses to the survey expressed a preference for retaining the rural character of the area.

Business and Industry — 200 acres zoned; 180 of which remain vacant.

Most of this land is on the north side of Arizona Highway 92 and on a quarter-section on the north of AZ 92 about 0.25 mile east of the San Pedro River

The goal is that new nonresidential development would complement the rural, small town, recreational and ranching character of the valley

Industrial uses are considered more suitable in the Sierra Vista employment center, where infrastructure exists to support such activities

Residential Neighborhoods — Residential development is made up of "mostly . . . large lot development of 4 acres or larger with the exception of the population centers of Miracle Valley, Palominas, and the Rancho Palominas Subdivision."

Densities are defined as follows:

High density: less than 36,000 square feet lot size.

Medium density: 36,000 square feet but less than 4 acres.

Rural density: 1 residence per 4 acres and grazing land for properties likely to remain as agricultural uses on a voluntary basis

The Southern San Pedro Area Plan envisions some growth in rural areas while maintaining community character. It suggests zoning 200 acres for commercial development, 180 acres of which is vacant. The plan contains policies for keeping important wash corridors available for groundwater recharge and for minimizing light pollution.

Infrastructure within U.S. Border Patrol, Naco-Douglas Corridor, Cochise County, Arizona. To help fulfill the U.S. Border Patrol's mission to reduce illegal immigration

and drug trafficking along the U.S.–Mexico border, infrastructure projects that have been approved by the Immigration and Naturalization Service have been analyzed under the NEPA process through the preparation of an environmental assessment. The Border Patrol proposes to improve 280 miles of road along the Mexico border and install other infrastructure components. Roads would be widened, and culverts, bridges, and low-water crossings would be added. These actions would promote safer driving and enhance the Border Patrol's response capabilities.

New fencing 10–14 feet high would be erected along the border near points of entry to prevent illegal passage. Vertical lengths of 4–5-inch diameter piping about 3 feet high would be placed as vehicle barriers to impede illegal entry. These upright barriers would not prevent pedestrian or wildlife movement. In addition, stadium style lighting and cameras would be installed at key infiltration points.

In the memorial, rail-on-rail barriers would be placed in various locations near the U.S.–Mexico border, from the memorial's eastern boundary west to Smugglers Wash and at the head of Smugglers Wash. The barriers would be made of posts 4–5 feet high spaced 4 feet apart, with a rail about 3 feet above the ground level connecting the posts.

IMPAIRMENT

In addition to determining the environmental consequences of the preferred alternative and other alternatives, NPS policy (*Management Policies 2001*, § 1.4) requires that potential effects be analyzed to determine whether or not proposed actions would impair the resources of the national memorial.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid or minimize, to the greatest degree practicable, any adverse effects on the resources and values of a park system unit. However, the laws do give the National Park Service the management discretion to allow impacts on resources and values when necessary and appropriate to fulfill the purposes of a national park system unit, as long as the impact does not constitute *impairment* of the affected resources and values.

Although Congress has given the National Park Service the management discretion to allow certain impacts, that discretion is limited by the statutory requirement that a park's resources and values must be left unimpaired unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of the resources and values, including the opportunities that otherwise would be present for the enjoyment of those resources or values.

Any effect on a resource or value may constitute an impairment, but an action would be most likely to constitute an impairment if it would result in a major effect on a resource or value whose conservation would be (a) necessary to fulfill specific purposes the park unit's establishing legislation or proclamation, (b) key to the natural or cultural integrity of the park system unit or opportunities to enjoy it, or (c) identified as a goal in the general management plan of the park system unit or other relevant NPS planning documents. Impairment could result from NPS activities in management, from visitor activities, or from activities undertaken by concessioners, contractors, and others operating in the park system unit. In this document, a determination about impairment is made in the conclusion section for each appropriate topic in the "Environmental Consequences" chapter.

METHODOLOGY

HOW EFFECTS WERE ANALYZED

This section contains descriptions of the methods used to analyze the environmental consequences of each alternative. First, the methodologies and assumptions common to all topics are described, followed by the methodologies specific to individual resource topics in the following areas:

- Natural Resources: air quality; cave resources; soils; vegetation; threatened, endangered, or sensitive species; water quality; and wildlife
- Cultural Resources: archeological resources, historic structures, ethnographic resources, and cultural landscapes
- Visitor Understanding and Recreational Resources
- The Socioeconomic Environment

The potential effects are described in terms of *type* (would the effect be beneficial or adverse?) *duration* (would the effect be short term — lasting less than one year — or long term — lasting more than a year?), and *intensity* (would the effect be negligible, minor, moderate, or major?) The definitions of intensity vary by effect; separate intensity definitions have been identified for each topic analyzed.

For each resource topic, the *context* of the effect would be local (affecting resources only in the national memorial) or regional (extending beyond national memorial boundaries). This is the general definition for *local* or *regional* context; any specific aspect of what constitutes a local or regional effect for a given topic has been defined under "context" for that topic's methodology.

Where possible, mitigative measures have been specified that would avoid, reduce, or compensate for potential adverse effects.

Pursuant to NEPA requirements, the impact analyses for alternative A (the existing management direction or no-action alternative) compare resource conditions that would exist in 2020 to existing conditions in 2000. The analyses of the action alternatives (B–E) compare the conditions that would result from the alternative in 2020 to those of the no-action alternative in 2020.

It is assumed that annual visitation to the national memorial would increase between 2000 and 2020. Although the amount of increase is not known, it is assumed that the annual visitation in 2020 would be the same under all the alternatives and that the accommodation of annual visitation demand would be the same.

This plan is a management plan, rather than an action or implementation plan. It is prescriptive, prescribing management actions to guide the managers of Coronado National Memorial in managing the memorial's resources.

To present to decision-makers and the public an accurate idea of the environmental consequences of the alternatives, the analysis team identified potential actions that could result from the application of the management prescriptions under each action alternative and analyzed their effects as compared to conditions under the no-action alternative. The environmental consequences analyses are qualitative rather than quantitative, because the action alternatives are conceptual.

METHODS OF ASSESSING EFFECTS ON NATURAL RESOURCES

Air Quality

Air quality refers to the concentration of contaminants present in either indoor or outdoor air. The presence of a variety of air pollutants is measured and regulated by state agencies according to the Clean Air Act. No air quality monitoring takes place in the memorial, and air quality is analyzed by qualitative estimates of the presence of contaminants that could be detected by staff and visitors. Parameters considered are particulate matter (dust), emissions from equipment (fumes), and odor.

Context — Local effects on air quality would be those occurring within the national memorial. Regional effects would extend beyond the memorial's boundaries.

Intensity — The intensity of impacts on air quality has been evaluated as follows:

Negligible: No changes would occur, or changes in air quality would be below or at the level of detection. If detected, the effects would be slight.

Minor: The changes in air quality would be measurable but small and localized. No mitigative measures would be necessary.

Moderate: The changes in air quality would be measurable and would have consequences, although the effect would be relatively local. Mitigative measures would be necessary and probably would be successful.

Major: The changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally. Mitigative measures would be necessary, and their success could not be guaranteed.

Type — Beneficial effects would improve air quality by reducing the concentrations of pollutants or nuisance dust; adverse effects would degrade air quality by increasing the presence these contaminants.

Duration — A short-term effect on air quality would be highly transient and persist only during activities generating dust or fumes. A long-term effect generally would result from changes in use patterns or the implementation of new actions and would persist beyond the period of dust or fume generation.

Cave Resources

Because caves form over millions of years, and because of the fragile nature of the formations they contain, caves are managed as nonrenewable resources. Any effect on the cave environment is considered long term. Any interruption or change in the hydrologic conditions that have caused the cave to form is also considered when assessing impacts on caves.

Context — The cave is relatively small, and all effects to the cave and its environment would be considered localized.

Intensity — The intensity of impacts on cave resources has been evaluated as follows:

Negligible: No changes would occur, or changes in cave formations and biota would be below or at the level of detection. If detected, the changes would cause effects that would be considered slight.

Minor: The changes in cave formations and biota would be measurable but small, and localized. No cave resource protection measures would be necessary.

Moderate: The changes in cave formations and biota would be measurable. Formations would be affected by deterioration or changed

depositional patterns, but the effect would be relatively local. Cave resource protection measures would be necessary and probably would be successful.

Major: The changes in cave formations and biota would be measurable, would have substantial consequences, and would be noticeable throughout the cave system. Cave resource protection measures would be necessary, and their success could not be guaranteed.

Type — Beneficial effects would be those that would improve cave resources by limiting human influence in the cave ecosystem; adverse effects would degrade or negatively alter cave resources.

Duration — Any effect on the cave environment is considered long term.

Soils

Alternatives could affect soils by changing the likelihood and rate of erosion. The changes have been identified as either beneficial or adverse.

Quantitative analysis of soil erosion is beyond the scope of this document because of the document's prescriptive nature. A qualitative analysis of the context, intensity, and duration of the potential effects is presented here.

Context — In many cases, local effects would extend over a small area in the national memorial, such as a few feet beyond a construction site. In other cases, such as in grazing allotments, local effects could cover hundreds of acres in the memorial. Regional impacts would affect soils that extend beyond the boundaries of the national memorial.

Intensity — The intensity of soils impacts has been evaluated as follows:

Negligible: The effect would be detectable but would have no discernible effect on the rate of soil erosion and/or the ability of the soil to support vegetation.

Minor: The effects would be detectable but would not change the ability of soils to support vegetation.

Moderate: The effect would be clearly detectable and could appreciably change the rate of erosion and/or the ability of the soil to support vegetation. Mitigating measures would be needed to offset adverse effects.

Major: The action would have a substantial, highly noticeable influence on the rate of soil erosion and/or the ability of the soil to support vegetation.

Type — Beneficial effects would improve soil resources by restoring areas and limiting development; adverse impacts would deplete or negatively alter soil resources.

Duration — A short-term effect on soils would be temporary, associated with transitional types of activities such as facility construction, resulting in effects that would be reduced to negligible levels after two or three growing seasons. A long-term effect typically would last months or years, continuing to be apparent after two or three growing seasons.

Vegetation

The plant communities considered in a 1991 analysis (Ruffner and Johnson 1991) were grouped into four general vegetation types for ease of discussion: oak-Mexican piñon-juniper association, grama species mixed grass-mixed shrub association, sycamore-walnut-oak association, and honey mesquite-mixed short tree association. The qualitative analysis of vegetation relied substantially on professional judgment.

The starting point for assessing impacts is natural processes, including the size, physical foundation, and components of the natural

communities and ecosystems. The relative extent of a plant community is determined by comparing its size to that of other similar communities within a defined area. Larger areas of intact vegetation create larger areas for wildlife and for ecosystem function. Therefore, new areas of development, however small, within otherwise intact and undisturbed areas constitute a greater impact on the overall vegetation of the area than the direct impact on that particular acreage.

In efforts to restore overall vegetative integrity and ecosystem health, small areas of restoration surrounded by existing or new development would constitute a lesser beneficial effect than would restoring a small area adjacent to a larger intact community or restoring large areas with little to no surrounding impact. Radiating effects (effects resulting from human use spreading out beyond developments, including parking, housing areas, and trails) can affect plant community size and continuity: soils can be disturbed and compacted, native vegetative cover can be trampled, and the potential for the introduction and establishment of nonnative species can be increased.

The natural structure of a plant community is measured by the presence or absence of nonnative species, the opportunity for natural processes such as fire and flood to occur, and the presence or absence of natural structural layers, or strata. Biotic integrity can be defined as the ability to support and maintain a balanced, integrated, adaptive community of organisms having species composition, diversity, and functional organization comparable to that of a natural habitat of the region. Diversity and productivity are important for vegetation communities as a whole because the interaction of species and presence of different components provides for ecosystem health and habitat for other species.

The measure of these parameters includes the ability to control, eradicate, or prevent the establishment of nonnative plant species and the ability to manage vegetation with a full range of management options to maintain natural structure and diversity. For example, the presence of nonnative species decreases the value of any particular area of vegetation by altering the contribution the vegetation makes toward habitat for wildlife and other organisms. Nonnative species also alter the effects of natural processes such as flooding or fire by changing the physical characteristics of the plant community.

Context — A local effect would occur within the memorial's boundaries. Local effects would cause changes in a limited area, such as constructing a parking lot or similar facilities. Regional effects would extend beyond the boundaries of the national memorial.

Intensity — The intensity of effects on vegetation has been evaluated as follows:

Negligible: The effect would result in no measurable or perceptible changes in the size, integrity, or continuity of the plant community.

Minor: The action would have a measurable or perceptible and localized effect within a relatively small area, but the overall viability of the plant community would not be affected.

Moderate: The action would cause a change in the size, integrity, or continuity of the plant community, but the impact would remain localized. The change would be measurable and perceptible, but it could be reversed.

Major: The effect would be substantial, highly noticeable, and could permanently affect the size, integrity, continuity, productivity, and structure of the plant community.

Type — Beneficial effects would improve conditions necessary to support native vegetation by restoring areas and limiting

development; adverse impacts would deplete or negatively alter native vegetation.

Duration — A short-term effect on vegetation would be temporary (typically lasting days or weeks) and would be associated with transitional types of activities such as the generation of dust during facility construction. A long-term effect typically would last months or years.

Threatened, Endangered, or Sensitive Species

The National Park Service is mandated to protect the natural abundance and diversity of the memorial's naturally occurring communities. The ability to complete a quantitative analysis is limited by the prescriptive nature of the alternatives. To assess the effects on threatened or endangered species and species of special concern, the following had to be determined:

(a) which species are found in areas likely to be affected by management actions associated with the alternatives

(b) the habitat loss or alteration that would be caused by each alternative

(c) the displacement and disturbance potential of the actions and the species' potential to be affected by the activities

(d) the compensating or offsetting effects of proposed mitigating measures that would be associated with the alternative.

The information in this analysis was based on professional judgment and literature review.

Context —A local effect would occur within the memorial's boundaries, causing changes in a limited area; for example, constructing a parking lot or similar facilities. Regional effects would extend beyond the national memorial's boundaries.

Intensity — The intensity of effects on threatened or endangered species or species of concern has been evaluated as follows:

Negligible: No federally listed or sensitive species would be affected, or the action would affect an individual of a listed species or its critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. A negligible effect would equate with a "no effect" determination in U.S. Fish and Wildlife Service terms.

Minor: The action would affect an individual(s) of a listed or sensitive species or its critical habitat, but the change would be small. A minor effect would equate with a "may effect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely" or "not likely" to adversely affect the species.

Moderate: An individual or population of a or sensitive species, or its critical habitat, would be noticeably affected. The effect would have consequences to the individual, population, or habitat. A moderate effect would equate with a "may effect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely" or "not likely" to adversely affect the species.

Major: An individual or population of a listed or sensitive species, or its critical habitat, would be noticeably affected with a vital consequence to the individual, population, or habitat. A major effect would equate to a determination in U.S. Fish and Wildlife Service terms of "may effect" or "is likely to adversely affect" the species or critical habitat.

Type —Beneficial effects would protect threatened, endangered, or sensitive species or improve their habitats by restoring areas and limiting development; adverse impacts would deplete or negatively alter habitat for

threatened, endangered, or sensitive species.

Duration — A short-term effect on threatened, endangered, or sensitive species would be temporary (typically lasting days or weeks) and would be associated with transitional types of activities facility construction. A long-term effect typically would last months or years.

Water Quality

Water quality refers to the suitability of surface water for recreational use and wildlife habitat. Analyzing effects on water quality deals particularly with the enhancement or degradation of the water's quality. NPS *Management Policies 2001* require that the National Park Service take "all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations." The Clean Water Act requires that federal agencies "comply with all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution." In this document, particular consideration has been given to actions with the potential to affect the natural hydrology and surface water quality of the ephemeral streams and drainages in the memorial.

Context — A local effect would occur within the memorial's boundaries. Local effects would cause changes in a limited area, such as constructing a parking lot or similar facilities. Regional effects would extend beyond the boundaries of the national memorial.

Intensity — The intensity of effects on water quality has been evaluated as follows:

Negligible: The effect would not be detectable and would not result in a discernible change in water quality.

Minor: The effect would be slightly detectable but would not result in an overall change in water quality.

Moderate: The action would cause a change that would be clearly detectable and could have an appreciable effect on water quality.

Major: The action would result in a substantial, highly noticeable influence on water quality.

Type — Beneficial effects would lead to improved water quality; adverse effects would result in poorer water quality or the reduced ability of water to meet its beneficial use.

Duration — Short-term effects would occur during the time that the alternative was being implemented and usually would last less than two years (such as construction projects). A long-term effect would last more than two years, remaining after the alternative had been implemented. Since the full implementation of an alternative would take place over a number of years, rather than considering the effects during the full implementation of the alternative, frequently the duration of the effects of individual actions of the alternative (restoring a trail, constructing a visitor center) have been assessed.

Wildlife

Information from literature was used to assess the probable impacts on wildlife from the alternatives. Surveys of terrestrial mammals (Swann et al. 2000) and amphibians and reptiles (Swann, Alberti, and Schwalbe 2001) were relied upon for the distribution of species in the memorial and their relative abundance. Qualitative analysis relies substantially on professional judgment to reach reasonable conclusions.

The analysis of effects on wildlife was based on the following assumptions:

- The more developed an area becomes, the less valuable it is as wildlife habitat. New development would increase human presence and the potential for disturbance of soils, vegetation, and wildlife. The potential for negative wildlife interactions (such as human injury from wildlife and the introduction of unnatural food sources) also would increase. Removing development from an area would increase the value of the habitat.
- The effects of human food on the behavior, distribution, and abundance of wildlife species would continue in existing developments and would begin in new developments unless adequate facilities, education, and enforcement were available.
- Development and activities near sensitive habitat may adversely affect adjacent natural communities.
- Disturbance in or near hydrological features might reduce the productive capability associated with natural communities. Modifications that result in soil compactions, loss of riparian vegetation, and accelerated erosion and sediment transport influence important habitat characteristic such as substrate type, location, and cover. These physical aspects often determine the composition of vegetative and wildlife communities.
- Roads and trails generally form barriers for wildlife and fragment habitat.

Context — A local effect would occur within the memorial's boundaries. Local effects would cause changes in a limited area, such as constructing a parking lot or similar facilities. Regional effects would extend beyond the boundaries of the national memorial.

Intensity — Effects on biological resources are considered beneficial if an action causes no detrimental effect and results in an increase in species or habitat components, native ecosystem processes, native species richness/diversity, or native habitat quantity and quality. The intensity of effects on wildlife has been evaluated as follows:

Negligible: The action would not be detectable and would have no principal effect on biological resources.

Minor: The effect on wildlife would be slightly detectable but would not be expected to have an overall effect on the natural community structure.

Moderate: The effect would be clearly detectable and could cause an appreciable change in individual species, community ecology (for example, the different kinds of amphibians present), or natural processes such as fire.

Major: The action would result in a substantial, highly noticeable effect on natural resources. This would include substantial effects on individual species, community ecology, or natural processes.

Type — Beneficial effects would protect wildlife or improve their habitats by restoring natural processes and limiting development; adverse impacts would deplete or negatively alter wildlife resources.

Duration — A short-term effect on wildlife typically would last days or weeks and would be associated with transitional types of activities such as facility construction. A long-term effect typically would last months or years.

METHODS OF ASSESSING EFFECTS ON CULTURAL RESOURCES

The effects on archeological resources, historic structures, ethnographic resources,

and cultural landscapes were assessed as described in the following paragraphs.

The cultural resource impact analysis is described in terminology consistent with the regulations of the Council on Environmental Quality (CEQ), and it is intended to comply with the requirements of both the National Environmental Policy Act and section 106 of the National Historic Preservation Act.

The assessment of effects on cultural resources is based on the regulations of the Advisory Council on Historic Preservation (36 CFR 800), which require federal agencies to consider the effects of actions on properties included on, or eligible for inclusion on, the National Register of Historic Places and to give the advisory council a reasonable opportunity to comment. The potential effects on cultural resources were identified and evaluated by: (a) identifying the areas that could be affected, (b) identifying cultural resources present in the area of potential effects that either are listed on or eligible for listing on the National Register of Historic Places, (c) identifying the extent and type of effect, (d) assessing those effects to avoid, reduce, or mitigate adverse effects according to procedures established in the advisory council's regulations, and (e) considering ways to avoid, reduce, or mitigate adverse effects.

This also applies to properties not formally determined eligible, but which are considered to meet eligibility criteria. All NPS undertakings affecting historic properties are subject to the provisions of the 1995 programmatic agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. Applicable legislation and regulations and specific management procedures regarding cultural resources are detailed in the NPS Director's Order 28, "Cultural Management Guideline" (NPS 1998a).

Under the advisory council's regulations, a determination of either "adverse effect" or "no adverse effect" must be made for affected cultural resources eligible for listing on the national register. An adverse effect occurs whenever an action alters, directly or indirectly, any characteristic of a cultural resource. Examples of alteration would be diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects that would be caused by the preferred alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, "Assessment of Adverse Effects"). A determination of "no adverse effect" means that there would be an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion on the national register.

CEQ regulations and the NPS Director's Order 12, *Conservation Planning, Environmental Impact Analysis and Decisionmaking* also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (for example, reducing an impact from major to moderate or minor). However, any resultant reduction in the intensity of an impact from mitigation would be an estimate of the effectiveness of the mitigation under the National Environmental Policy Act only. This would not suggest that the level of effect as defined by section 106 would be similarly reduced. Although adverse effects under section 106 may be mitigated, the effect would remain adverse.

A section 106 summary is included in the analysis of effects. These summaries are intended to meet the requirements of section 106 by assessing the effects of the actions on cultural resources that are either listed on or eligible to be listed on the National Register of Historic Places, on the basis of the criteria of effect and adverse effect in the advisory council's regulations.

This methodology applies to four types of cultural resources: archeological resources, historic structures, ethnographic resources, and cultural landscapes.

Context — The affected area is the memorial and Cochise County. Cultural resources impacts should not extend beyond these areas.

Type — Beneficial effects on cultural resources would be greater protection and preservation of the resource. Adverse effects would occur whenever an action would directly or indirectly alter any characteristic of a cultural resource that would qualify it for inclusion on the National Register of Historic Places (for example, by diminishing the integrity of its location, design, setting, materials, workmanship, feeling, or association). This definition follows the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5).

Duration *(except for ethnographic resources)* — Short-term impacts would be less than one year because most construction is generally completed within a year's time and would last only until all construction-related action items were completed. Long-term impacts would extend beyond one year and have a permanent effect on cultural resources.

Archeological Resources

Certain important research questions about human history can be answered only by the actual physical material of cultural resources. Archeological resources have the potential to answer such research questions in whole or part. Archeological resources typically are considered eligible for inclusion on the National Register of Historic Places because they have yielded, or may be likely to yield, information important in history or prehistory. An archeological site can be nominated to the national register in one of three historic contexts or levels of significance: local, state, or national (National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation.*)

For the purposes of analyzing the effects on archeological resources, thresholds of change for the intensity of an impact are based on the potential of each site to yield information important in prehistory or history, as well as on the probable historic context of the site. The intensity of impacts on archeological resources also relates to the importance of the information they contain and the extent of disturbance or degradation.

Intensity — Consistent with CEQ regulations, the intensity of the effects on archeological resources has been evaluated as follows:

Negligible: The effect would be so slight as to be barely measurable with no perceptible consequences and no meaningful implications. It would be confined to a small area, or the area affected would be a single contributing element of a larger national register district or archeological site(s) with low data potential.

Minor: The action would affect an archeological site with little or no potential to yield information important in history or prehistory. The affected archeological resource generally would be ineligible to be listed on the national register. The effect would be perceptible and measurable but would remain local and confined to a single contributing element of a larger national register district or archeological site.

Moderate: The effect would be readily apparent. The action would affect an archeological site or sites with local or state context and with potential to yield information important in history or prehistory.

Major: The effect would be severe or of exceptional benefit. The action would

affect an archeological site or sites with national historic context and with potential to yield important information about human history or prehistory.

Historic Structures

To be listed on the National Register of Historic Places, a structure must be associated with an important historic context; that is, it must possess significance (the meaning or value ascribed to the structure), and it must have integrity of the features necessary to convey its significance: location, design, setting, workmanship, materials, feeling, and association (as described in *National Register Bulletin 15, How to Apply the National Register Criteria for Evaluation).*

Intensity — The intensity of the potential impacts on historic structures has been evaluated as follows:

Negligible: The effect would be at the lowest levels of detection; it would be barely perceptible and not measurable.

Minor: The action would not affect the character-defining features of a structure listed on or eligible for the National Register of Historic Places.

Moderate: The effect would be an alteration of character-defining features of a structure, but the integrity of the resource would not be diminished to the extent that its national register eligibility would be jeopardized.

Major: The action would alter a character-defining feature of a structure, diminishing its integrity to the extent that it would no longer be eligible for listing on the national register.

Ethnographic Resources

Ethnographic resources are resources that and are important in maintaining the continuing cultural identity of the community and to which communities ascribe cultural significance. Only members of the community to which the resources hold cultural value can identify ethnographic resources and determine the potential effects on them. Ethnographic resources are considered eligible for inclusion on the national register as traditional cultural properties when they are rooted in a community's history and meet the criteria for evaluation and integrity.

After initial consultation meetings with representatives of American Indian tribes with possible traditional associations with lands and resources in Coronado National Memorial, the National Park Service has determined that the tribes listed on this page are most closely associated with resources of the memorial that could be affected by NPS actions.

Duration — Because the ethnographic resources identified by the tribes are important in each tribe's history and because the resources are interconnected with places and resources located throughout customary tribal lands, any impacts on ethnographic resources would be regional in scope. Effects on the resources also would affect the communities to which they are perpetually tied. Therefore, the duration of impacts on ethnographic resources would be long term.

Tribes Associated with Resources in Coronado National Memorial
Ak-chin Indian Community
Fort McDowell Mojave-Apache Community
Fort Sill Apache Tribe of Oklahoma
Hopi Tribe
Mescalero Apache Tribe
Pascua Yaqui Tribe of Arizona
Pueblo of Zuni
Salt River Pima-Maricopa Indian Community
San Carlos Apache Tribe
Tohono O'odham Nation
Tonto Apache Tribe
White Mountain Apache Tribe

Yavapai - Apache Tribe

Intensity — The intensity of effects on ethnographic resources may relate to access and use of, as well as changes to, traditionally important places. Although the tribes themselves did not identify the intensity of potential impacts on ethnographic resources, the National Park Service has defined the intensity as follows:

Negligible: The effect would be at the lower levels of detection.

Minor: The effect would be slight, but detectable.

Moderate: The effect would be readily apparent.

Major: The effect would be severely adverse or exceptionally beneficial.

Any adverse impacts on ethnographic resources would be readily apparent to the tribes to which the resources hold cultural significance. In most cases, because effects on these resources would affect cultural identity and ways of life, the intensity of most effects, whether positive or adverse, would be moderate to major.

Coronado National Memorial contains no traditional cultural properties (ethnographic resources eligible for listing on the National Register of Historic Places); therefore, the impact sections for this topic in each alternative will not contain a "Section 106 Summary."

Cultural Landscapes

Cultural landscapes impart a living record of an area's past, a visual chronicle of its history. Shaped through time by historical land management practices, by politics and property laws, by levels of technology and economic conditions, cultural landscapes are the result of long interaction between people and the land, the influence over time of human beliefs and actions on the natural landscape. However, the dynamic nature of modern human life contributes to the continual reshaping of cultural landscapes, making them a good source of facts about specific times and places. At the same time, the long - term preservation of cultural landscapes is a challenge.

For a cultural landscape to be listed on the National Register of Historic Places, it must possess significance (the meaning or value ascribed to the landscape) and have integrity of the features necessary to convey its significance. The character - defining features of a cultural landscape are its spatial organization and land patterns, structures and buildings, site furnishings and objects, circulation patterns, topography, vegetation, and water features (USDI 1996).

Intensity — The intensity of effects on cultural landscapes has been evaluated as follows:

Negligible: The effect would be at the lowest levels of detection; it would be barely perceptible and not measurable.

Minor: The action would not affect the character - defining features of a cultural landscape listed on or eligible for listing on the National Register of Historic Places.

Moderate: The action would alter a character - defining feature of the cultural landscape but would not diminish the integrity of the cultural landscape to the extent that its national register eligibility would be jeopardized.

Major: The action would alter a character - defining feature of a the cultural landscape, diminishing its integrity to the extent that it would no longer be eligible for listing on the national register.

Mitigation and Section 106

Mitigation for NEPA purposes in this environmental impact statement includes avoiding, rectifying, or compensating for the impact. Every effort would be made to avoid adverse impacts on cultural resources. When avoidance was neither feasible nor prudent and the undertaking could result in adverse impacts, a number of mitigating measures might be employed.

The Council on Environmental Quality calls for a discussion of the *appropriateness* of mitigation, and the NPS *Handbook to Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision Making* requires an analysis of the *effect* of mitigation. The resulting reduction in intensity from mitigation is an estimate of the effectiveness of mitigation under the National Environmental Policy Act. It does not suggest that the level of effect as comprehended by section 106 of the National Historic Preservation Act be similarly reduced. Although adverse effects under section 106 may be mitigated, for example, the effect remains adverse.

The "Effects on Cultural Resources" section of this chapter (beginning on p. 192) includes an analysis, conclusion, and "section 106 summary" for each subtopic. The section 106 summary, which is intended to meet the requirements of section 106 of the National Historic Preservation Act, assesses the effects of the undertaking (implementing the alternative) on historic properties. This summary is based on the criterion of effect and criteria of adverse effect found in council's implementing regulations.

METHODS OF ASSESSING EFFECTS ON VISITOR UNDERSTANDING AND RECREATIONAL RESOURCES

The visitor experience in Coronado National Memorial encompasses a spectrum of elements, including access to recreational opportunities, the availability of such opportunities, and access to interpretation and orientation programs. For each alternative, three aspects of the visitor experience were evaluated: access to resources, interpretation and orientation, and visitor numbers and recreation. Every visitor to the national memorial brings unique expectations; thus, each visitor has a unique experience. The ways in which the actions and management prescriptions of each alternative might alter the quality of the visitor experience were considered.

Developing a quantitative analysis of the potential effects on the visitor experience is not feasible because the plan is prescriptive. In the qualitative analysis, professional judgment was used to reach reasonable conclusions as to the intensity and duration of potential impacts.

The following assumptions were used in the analysis:

- Visitor demand would be the same in all the alternatives.
- There would be no fundamental change in visitor access by private vehicle to the national memorial.

For access to resources, interpretation, and orientation, the impact analysis was based on whether the actions and management prescriptions of each alternative would change the availability of the existing range of interpretation programs and orientation and information sources and services throughout the memorial.

The impact analysis for visitor numbers and recreation was based on whether an alternative would result in a complete loss of recreational opportunity, a change in access to or availability of a recreational opportunity, or a change in the aggregate of recreational opportunities for visitors. This assessment is specifically concerned with whether the

availability of some aspect of visitor use would be altered. The change in the characteristics or quality of the experience was not considered in determining the intensity of an impact.

Context — Local effects would be those confined to Coronado National Memorial and Cochise County. Regional effects would extend beyond this geographic region to other counties or across the Mexican border to the south.

Intensity — The intensity of effects on the visitor experience and recreational resources has been evaluated as follows:

Negligible: The effect would be barely detectable, would not occur in primary resource areas, or would affect few visitors.

Minor: The effect would be slight but detectable, would not occur in primary resource areas, or would affect few visitors.

Moderate: The effect would be readily apparent, would occur in primary resource areas, or would affect many visitors.

Major: The effect would be severely adverse or exceptionally beneficial, would occur in primary resource areas, or would affect the majority of visitors.

Type —Beneficial effects would consist of greater access to or availability of a recreational experience or an opportunity for interpretation or orientation programs. Adverse effects would involve less availability of recreational resources or fewer opportunities for interpretation or orientation programs.

Duration — A short-term effect on visitor services, the visitor experience, or recreation would be temporary and associated with transitional types of effects such as dust generation during facility construction. A long-term effect would last longer and might permanently affect the visitor experience.

METHODS OF ASSESSING EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

The effects of the alternatives on the local and regional economy were analyzed. Quantitative analysis of potential effects on the socioeconomic environment was not feasible because the plan is prescriptive. Therefore, the analysis of effects was qualitative, and professional judgment was used to reach reasonable conclusions as to the context, intensity, type, and duration of potential impacts.

Context — The context of the analysis is local and regional, covering the national memorial, Cochise County, and the communities within the county. It is not expected that socioeconomic impacts would extend in Arizona beyond Cochise County or across the border into Mexico.

Intensity — The intensity of socioeconomic effects has been evaluated as follows:

Negligible: The action would not have an effect on the socioeconomic environment that would be distinguishable from changes that were occurring from other social and economic activities within the county and its communities.

For grazing, the effects of the action could not be distinguished from effects on the number of cattle raised locally associated with factors such as season, climate, or market prices. For the socioeconomic effects of recreation use, the effects of the action could not be distinguished from effects resulting from factors such as the price of gasoline, the exchange rates between dollars and

pesos, and the occurrence of a national expansion or recession.

Minor: The effect on socioeconomic conditions would be small but measurable in nearby communities such as Palominas, Hereford, and Bisbee. They would not be distinguishable from changes that were occurring from other social and economic activities in larger or more distant towns (such as Sierra Vista and Douglas) or on a county-wide basis.

For grazing, a change in the number of cattle raised locally could be discerned from changes caused by other factors, but a county-wide change could not be detected.

For the socioeconomic effects of recreation use, the effects of the action in small, nearby communities could be discerned from those resulting from broad economic influences, but such changes could not be established on a county-wide basis.

Moderate: The effect on socioeconomic conditions would be readily apparent and widespread in nearby, small communities. Changes would be detectable in larger cities such as Sierra Vista and Douglas, and throughout Cochise County. County-wide changes in cattle production could be detected. It could be established that county-wide socioeconomic effects from changes in recreation use were attributable to management actions in the monument.

Major: Major effects on socioeconomic conditions would be readily apparent and would substantially change the economy or social services in Cochise County.

Type — A beneficial socioeconomic effect would increase economic activity or improve social services or conditions in the affected area. Adverse socioeconomic effects would decrease economic activity or cause social services or conditions in the affected area to deteriorate.

Duration — A short-term socioeconomic effect would be temporary, and often it would be related to a specific action such as construction. It would not extend for more than a month or two beyond the completion of that action. Any socioeconomic effect that would extend for more than a year would be a long-term effect.

EFFECTS ON NATURAL RESOURCES

ALTERNATIVE A

Air Quality

Analysis. Alternative A probably would not result in any change in air quality at the memorial. There would be few or no changes to visitor facilities, and no roads or trails would be constructed. No construction equipment would be present in the memorial, and no fugitive dust would be generated. Visitation would continue to increase at the current rates. Under these circumstances, there would be no measurable effects on air quality. The memorial would continue to attain the prescribed air quality.

Cumulative Effects. The implementation of other projects and plans at the national memorial would not adversely affect air quality. Regionally, the population of Cochise County increased by just over 20 percent from 1990 to 2000. The memorial's air quality would be more likely to be affected by local population growth and development and by wind-borne pollution from distant sources than by management activities in the memorial. The no action alternative would not contribute to regional effects on air quality.

Conclusion. Alternative A would result in no measurable effects on the air quality at Coronado National Memorial.

Cave Resources

Analysis. There are a number of caves in the national memorial, with Coronado Cave being the most prominent and accessible (0.75 mile from the visitor center). This has resulted in a visitation, by permit, of between 5% and 6% of the people that currently come to the memorial. The cave contains various limestone formations (stalactites, stalagmites, flowstone, and helicites) and provides habitat for animals. Occasionally visitors might cause slight damage to cave resources. In any one year, the damage results in negligible to minor adverse effects on cave resources. However, the loss of resources year after year could eventually result in minor long-term adverse effects on cave resources.

Cumulative Effects. The opening of Kartchner Caverns State Park about 35 miles north of the memorial has increased the interest of the visitors in caves. This interest added to the accessibility of Coronado Cave has resulted in a slight increase in visitation to the memorial's cave. This increased interest in caves has resulted in a slight loss of sensitive cave resources in the area of Cochise County.

Conclusion. Cave resources would continue to be impacted by visitors and time with the result of a long-term minor adverse effect.

Soils

Analysis. Removing the Montezuma Ranch structures would affect Gardencan-Larque complex soils, which are associated with shallow hills and sandy-loam uplands. The area affected would be about 25 acres, or less than 1% of the national memorial's grassland habitat. The slope of these soils is low, ranging from 0% to 10%, and the erosion potential in this area is low. Local impacts on soils from removing the structures would be short term and negligible to minor because mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area. Furthermore, the area would be revegetated.

Removing nonnative species and restoring and revegetating the area after the structures were removed would reduce soil compaction and increase permeability, improving soil properties. This would hold soils in place and reduce wind erosion. These long-term

beneficial effects would be negligible to minor.

Livestock grazing has been shown to affect soil structure and function, including soil porosity, chemistry, microbiology, nutrient cycles, productivity, and erosion rates (Roberson 1996). The gravelly, sandy-loam soils in the grazing allotments are subject to erosion caused by the loss of vegetative cover or the occurrence of infrequent torrential rains. Retaining the current levels of grazing would result in cattle hooves continuing to disturb cryptobiotic crusts (soil organisms that bind the soils and prevent soil loss), subjecting soils to wind and water erosion. Soils would continue to be susceptible to erosion when loosened by trampling or by the removal of vegetation (which stabilizes soils).

Erosion potentials are high on approximately 60% of the Joe's Spring allotment, where slopes exceed 30% (NRCS, USDA 2000). The steep slopes present in the Joe's Spring allotment however limits grazing in these areas. A positive correlation between slope and range condition has been noted in the Joe's Spring allotment, indicating that areas on lower slopes are more heavily grazed than steeper areas. Livestock use is concentrated on the lower slopes in the southern third of this allotment. This area has slopes that range from 0 to 10% with erosion factors ranging up to 0.32, indicating a medium level of susceptibility to sheet or rill erosion by water (NRCS, USDA 2000). Erosion problems such as soil compaction and soil loss have developed during more than 50 years of continuous grazing. Although there have been no livestock in the Montezuma allotment for several years, in this no-action alternative the possibility exists that the allotment might be used for grazing in the future. Accelerated erosion (as compared with most of the allotment) could occur on the relatively small parts of the Montezuma allotment that exceed a 20% slope.

With continued grazing soil compaction would occur. Evidence indicates that areas in the Joe's Spring allotment have become compacted with use (D. Robinett, Natural Resource Conservation Service, pers. comm.). This is particularly evident in the southeastern corner of the allotment where the cattle tend to congregate and in areas where they water. The Montezuma allotment, which has not been grazed since 1990, may be put back into use for livestock grazing at any time. In contrast to current conditions, the effects on soils from livestock use of this allotment would be clearly detectable. Increased soil compaction caused by livestock in those areas where they congregate, such as near water sources, would reduce soil fertility, which would lead to reduced plant productivity and changes in plant composition.

Implementing the *Livestock Management Plan* (NPS 2000b) is reducing the impacts on soils from grazing. Management activities such as reducing grazing intensity, shortening the season of use, limiting the use of riparian areas, controlling water sources, and using salt blocks are helping to mitigate impacts and protect soils. In addition, grazing management in the national memorial is now based on an adaptive management approach. A monitoring program developed to assess the condition of resources in the grazing allotments is used to adjust livestock numbers to protect resources. The adverse impacts on soils in these allotments that would result from grazing under the no-action alternative would be minor and long term.

Cumulative Effects. Because the national memorial is on a smuggling route for undocumented people and illegal drugs, such use has resulted in the creation of many footpaths, especially along drainages. The construction of a fence by the U.S. Border Patrol at the United States–Mexican border might funnel foot traffic westward into the memorial, which would create more footpaths, degrading soils and vegetation. In addition, soils in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Soil compaction and erosion would occur along existing trails and by the

creation of social trails. Similar effects result from the development of game trails by wildlife in the area. These activities, along with the activities associated with the no-action alternative, would result in minor adverse impacts on soils throughout the national memorial.

Conclusion. No expansion would be planned for the visitor center vicinity. Off-road parking (mainly during peak periods) and social trails would continue to compact soils.

Removing the Montezuma Ranch structures would result in negligible to minor short-term local adverse impacts on soils. Mitigating measures would be employed to avoid or reduce effects. Restoration of this site would offset any adverse effects and result in up to minor long-term benefits.

The effects on soils from continued grazing on the allotments would be reduced through an adaptive management approach that would monitor impacts on soils and vegetation and adjust the number of livestock accordingly. Erosion and compaction caused by continuing grazing on both allotments would result in minor adverse impacts on soils.

Vegetation

Analysis. Removing the Montezuma Ranch structures would affect grama grass-mixed grass-mixed shrub vegetation types by trampling, uprooting, and crushing vegetation. Removing the structures would expose soils to wind and rain erosion with the potential to adversely affect riparian areas. The ranch area is adjacent to drainages that contain riparian vegetation of the western honey mesquite-mixed short tree woodland association. The area of potential affect is about 25 acres. The slope of the soils is this area is low, ranging from 0% to 10%, with a low erosion potential. Local impacts on vegetation from removing the structures would be short term and negligible to minor because mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

In addition, the area would be restored with native plant species. Restoring and revegetating the ranch area after the structures were removed would reduce compaction and wind erosion and increase soil permeability. It also would restore the overall integrity of the vegetative community. These long-term beneficial effects would be negligible to minor.

Vegetation within the grazing allotments consists predominantly of grasses; however riparian vegetation of honey mesquite-mixed short tree woodland is supported along the drainages. The most common vegetative communities in the grazing allotments are oak-Mexican piñon-juniper association and grama species mixed grass-mixed shrub association. Nonnative and cool season grasses have replaced native warm season grasses in some parts of the allotments; this would continue (D. Robinett, Natural Resource Conservation Service, pers. com.). Even though grazing would continue in both allotments under this no-action alternative, the impacts from grazing on vegetation and in riparian areas is being reduced by the recent implementation of the *Livestock Management Plan* (NPS 2000b). Some of the measures that are reducing the effects of grazing include reducing grazing intensity, shortening the season of use, controlling water sources, and placing salt blocks away from riparian zones. Improvements will continue as these measures allow the riparian community to recover from past stresses associated with grazing. Reducing stocking levels and modifying the season of use is allowing native grass species to increase, which in turn is improving the range condition ratings in the allotments.

Modifying the season of use is helping to protect important areas of agaves during the growing season, increasing survival and improving the vegetation condition over time. (Cattle grazing on agave plants is of concern because the plants are important food for

nectarivorous bat species and for native herbivores, including pregnant white-tailed deer [Hawks, 1997].) The long-term beneficial effects on vegetation from implementing the actions of the *Livestock Management Plan* (NPS 2000b) are expected to be negligible to minor.

Monitoring has already started to improve the protection of vegetation. Modifying the grazing schedule during drought and after fire are maintaining and improving vegetative conditions. The cover and density of plants, especially warm season grasses, are expected to increase measurably after several years of *Livestock Management Plan* implementation. Bock et al. (1984) found that grass cover in an area excluded from grazing was substantially higher than in grazed areas. Brady et al. (1989) found no difference in plant cover within grazing exclosures but reported significantly higher cover of tall grasses such as plains lovegrass.

Although improvements to vegetation and range condition on the allotments will continue to occur, alternative A would continue grazing in the memorial resulting in a minor adverse effect on vegetative communities including riparian areas compared to alternatives that involve eliminating the grazing allotments. The diversity and cover of palatable grasses could change, with the species composition and overall abundance of vegetation cover being determined by the livestock management practices that are implemented. If management actions are loosely enforced, the abundance of palatable herbaceous species could decrease, and the distribution and abundance of woody shrub species and less palatable grasses and forbs could increase. The converse could occur with more aggressive livestock management according to the plan provisions. The speed of vegetative improvements would primarily depend on the grazing intensity that is permitted and the natural cycle of precipitation. Recovery would increase with lower livestock grazing intensity and more rain during the growing season.

Cumulative Effects. The footpaths along drainages resulting from the smuggling route for undocumented people and illegal drugs, along with the creation of more footpaths resulting from the construction of a fence by the U.S. Border Patrol, could degrade vegetation. This, along with the actions of the no-action alternative, would result in minor adverse impacts on vegetation throughout the memorial.

In June 1988 Coronado National Memorial was affected by the Peak Fire. In the memorial, the oak-Mexican piñon pine-juniper woodland association was most affected by the fast-moving, intense fire in continuous grass fuels because about 2,600 acres of the 3,700 acres that burned were in this habitat. Most of this biotic community was burned moderately, but some areas in the western part of the memorial were severely burned. However, by August 1989 many trees had resprouted either from the roots or from undamaged areas of the trunk.

The species composition of the woodland understory was significantly changed after the fire, probably because of the influx of nutrients or appropriate conditions for the germination of numerous herbaceous species that were either rare or absent before the fire. The grama grass-mixed grass-mixed shrub association was relatively unaffected by the fire because little fuel was present to sustain a high temperature. Consequently, the effect of the fire on this habitat was largely ephemeral because most of these species are fire-adapted and quickly resprout from roots. Under alternative A, vegetation would be disturbed, which would affect mainly grassland habitats; therefore, these disturbances would contribute little cumulatively to the past impacts of the 1988 wildfire.

Regionally, wildland fire is an increasing threat in scale and severity. Developing a fire management plan would reduce hazardous fuels in the memorial, diminishing the potential for wildland fire in the memorial and beyond its boundaries. A future fire

management plan, in combination with similar plans for Coronado National Forest and Fort Huachuca, would result in long-term minor benefits for vegetation in the region.

The encroachment of woody species into grasslands in the upper San Pedro Basin is a factor in regional decreases in the amount and ecological functioning of native grasslands and in their fragmentation into small, disconnected patches. Regional urban development also results in a loss of grassland acreage. Continuing grazing in the memorial would increase native shrubs, contributing to these cumulative adverse regional effects. Experimental investigation and treatments of Lehmann lovegrass are being conducted on Fort Huachuca. The no-action alternative would not contribute cumulatively to regional impacts on grasslands.

Conclusion. No expansion would be planned for the visitor center vicinity. Off-road parking (mainly during peak periods) and social trails would continue to impacts vegetation.

Removing the Montezuma Ranch structures would result in negligible to minor adverse short-term local impacts on vegetation. Mitigating measures would be used to avoid or reduce effects. Restoration and revegetation with native species would have a long-term negligible to minor beneficial effect.

The impacts on vegetation from continued grazing in the allotments is being reduced through an adaptive management approach that monitors the impacts on vegetation and adjusts the number of livestock accordingly. Minor adverse impacts on vegetation, including riparian vegetation, and range condition would result from erosion and compaction caused by continuing grazing on both allotments. However, modifying grazing management according to the *Livestock Management Plan* will improve range conditions compared to those that existed before the plan was implemented.

Threatened, Endangered, or Sensitive Species

Analysis. The Montezuma Ranch is about 2 miles from the roosting site of lesser long-nosed bats. Removing the ranch structures would have no effect on those roosting sites or on other abandoned mines in the memorial that are used for roosting sites by the Mexican long-tongued bat. Removing the structures might result in the loss of individual agave plants that are forage for the federally listed endangered lesser long-nosed and Mexican long-tongued bats and could displace small mammals that are prey to the loggerhead shrike (federally listed as a species of concern). Because the area disturbed would be small (about 25 acres) and the impacts from construction activity short-term and local, the adverse effects on the populations of either agaves or small mammals in the memorial would be negligible to minor. The effects on these listed or sensitive species from removing the ranch structures would be negligible.

The area that would be affected by removing the ranch structures (at a lower elevation on relatively level terrain vegetated largely with mixed grass and scrub) is outside the Mexican spotted owl's prime nesting and foraging habitat, which usually is found on slopes with gradients greater than 40 percent (USFWS 1995b). A survey of small mammals in the memorial (Swann et al. 2000) indicated a low availability of wood rats and peromyscid mice in the area of the ranch. Removing the structures would not be likely to adversely affect the Mexican spotted owl.

Restoring and revegetating the ranch might result in the establishment of more agave plants, which would benefit the nectar-feeding bats. Restoring the area also would increase the habitat available for small rodents and insects, which would result in negligible to minor beneficial effects on the loggerhead shrike.

Under alternative A, grazing would continue on both grazing allotments according to the

Livestock Management Plan (NPS 2000b). However, at present only the Joe's Spring allotment is being grazed. A mammal survey conducted in 1996–1997 indicated that the prey species of the Mexican spotted owl do not inhabit the grasslands of the Montezuma allotment. In the Joe's Spring allotment, the prey species are common in the grasslands but not common in the oak woodlands, which constitute about 29% of the vegetation. The prey species are common in the riparian areas of both allotments.

Because the grazing allotments lack suitable habitat for Mexican spotted owls, higher energy costs are necessary to reach the allotments, and the allotments have relatively low prey density and biomass, it is unlikely that the owls use the allotments. The National Park Service has determined, and the USFWS concurred that grazing under the *Livestock Management Plan* might affect but would not be likely to adversely affect Mexican spotted owls (Nov. 2, 2000).

The decline in agave plant populations throughout the range of the nectar-feeding bats has been cited as one of the reasons for federally listing the lesser long-nosed bat as endangered (USFWS 1994). Some studies found that cattle grazing is detrimental to agave, resulting in predation of flowering stalks and death of individual plants by trampling (Martinez-Morales and Meyer 1985; Hodgson and DeLamater 1988). However, in subsequent studies in Coronado National Memorial, Hawk (1997) found no significant differences in agave populations or flower stalk predation between grazed and ungrazed area. Instead, she found that high flower stalk predation occurred in all plots, and that native herbivores, including white-tailed deer, ate most of the flower stalks in areas where cattle were absent. Based on these findings, continued grazing in the memorial under alternative A would result in negligible effects on nectar-feeding bats. Alternative A would not be likely to adversely affect the lesser long-nosed bat.

Continuing grazing in the memorial would cause minor effects on wildlife species such as rodents, reptiles, small birds, and insects that are prey for the loggerhead shrike (also see "Wildlife," p. 143). Although grazing probably would not directly eliminate wildlife species, the population densities of some species might decline, and other generalist species could increase. Grazing probably would not change the overall availability of prey for loggerhead shrikes. Continuing grazing in the memorial might alter loggerhead shrike food sources, resulting in negligible direct and indirect adverse effects.

Cumulative Effects. A loss of trees in the memorial since 1978 and the resultant growth of high-elevation grasses since the wildfire of 1988 have resulted in an increase in rodent species and their predators (Ruffner and Johnson 1991). Continuing this trend would increase the prey availability of the loggerhead shrike, a minor beneficial effect for this species.

Forest vegetation provides habitat for species that require large areas of suitable forest cover and structure to maintain viable populations, most notably the threatened Mexican spotted owl. Wildfire is the primary threat to this species. The loss of about 2,600 acres of oak-pine-juniper woodlands in the memorial during the 1988 wildfire reduced nesting and foraging habitat. Without an active fire management program, woody fuels continue to accumulate in the memorial, increasing the potential for future wildland fire, which threatens the spotted owl habitat in the memorial and on adjacent lands. If there should be a catastrophic wildfire in the future that could not be suppressed, combined with previous adverse effects from fire on the owl habitat in the memorial, the impacts from wildfire would represent a moderate to major threat to the Mexican spotted owl. Actions to reduce hazardous fuel loads in Coronado National Forest that would be identified in a future fire management plan and that are now underway on Fort Huachuca would

cumulatively benefit the owl through reduced potential for habitat alteration.

The restoration of the grassland at Fort Huachuca would improve the ecological integrity and function of native grasslands and might increase the number agave plants, which would benefit nectar-feeding bats in the region. However, development in adjacent areas would continue to reduce grasslands, which could adversely affect agave populations. Implementing the *Livestock Management Plan* (NPS 2000b) is expected to result in an incremental increase in grassland and agave populations, which would locally benefit the national memorial but would not measurably affect the region.

Fort Huachuca and Coronado National Forest have developed plans to prevent the introduction of nonnative species, control the spread of others, and protect agaves on their lands. These efforts would increase the number of agave plants in the region, a minor to moderate benefit for the region's nectar-feeding bats. However, increasing development and continued grazing in adjacent areas would offset these benefits.

The effects that would result from alternative A, combined with the effects from other activities in the region, would result in cumulative adverse effects on critical habitat and on threatened, endangered, and special status species ranging from moderate to major. Implementing alternative A would contribute negligibly to the overall cumulative effect.

Conclusion. Current maintenance and operations activities would continue to have a negligible impact on wildlife.

Removing the Montezuma Ranch structures would disturb a small area, and the effects would be short-term and local, causing negligible to minor adverse effects on the populations of either agaves that are a food source for nectar-feeding bats or small mammals that are prey for the loggerhead shrike. The adverse effects to listed species would be negligible. The ranch area is not in prime foraging or nesting habitat for the Mexican spotted owl, and there is low availability of the owl's prey species in this location; therefore, removing the ranch structures would not adversely affect these owls.

Restoring and revegetating the ranch area might result in more agave plants, increasing the available food for nectar-feeding bats. Revegetating the area probably would increase the habitat and prey species of the loggerhead shrikes. Thus, there would be beneficial effects on the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike, and the restoration would not be likely to adversely affect these species. Because of the small portion of the national memorial affected, this alternative might affect the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike but would not be likely to adversely affect these species.

It is unlikely that Mexican spotted owls use the grazing allotments. Continued grazing in the memorial under alternative A, with the use of the *Livestock Management Plan,* would not be likely to adversely affect this species.

Alternative A also would not be likely to adversely affect the endangered lesser long-nosed bat.

Livestock grazing in the memorial under alternative A might adversely affect the loggerhead shrike by adversely affecting prey habitat for species that the loggerhead shrike relies on. These effects would be negligible.

Water Quality

Analysis. Removing the structures of the Montezuma Ranch (which is near a drainage but not directly adjacent to it) would expose soils to wind and rain erosion, and these soils could be deposited in the nearby drainage.

Because the soils are compacted, the slope of the area is low (0%–10%), and best management practices would be used to control erosion and site restoration, the short-term adverse effect on water quality from removing the structures would be negligible.

Restoring and revegetating the ranch area after the structures were removed would take place some distance from the riparian area, so the beneficial effects on water quality would be negligible, even though soil compaction would be reduced and permeability increased. Wind erosion would be reduced by the development of root systems through revegetation; this could benefit water quality.

Reducing the grazing intensity and shortening the season of use is improving watershed conditions by increasing vegetative cover along stream corridors. These practices also improve water quality by decreasing sedimentation, fecal coliform, and other microbes. However, grazing, even at reduced levels, would continue to degrade watersheds, causing soil erosion, reduced plant cover, and altered plant communities. The long-term adverse effects on water quality from continued grazing would be minor.

Cumulative Effects. Recreation, cattle grazing, ranching, road construction, water diversion, and urban development in the region all cumulatively affect soils, vegetation, and riparian environments, and consequently water quality.

Livestock grazing in riparian areas in upland communities would continue to affect water quality downstream on a reduced basis by reducing water infiltration and increasing runoff, erosion, sedimentation, and turbidity. The compaction of soils in grazed areas would continue to lead to reduced water infiltration and increased runoff, erosion, and sediment delivery to streams.

Continued grazing in the national memorial would contribute cumulatively to adverse effects on water quality. However, with the *Livestock Management Plan* in use, the effects of grazing in the memorial would be minimal in relation to other development and agricultural activities in the area. The effects on soils, vegetation, and riparian habitat in the memorial resulting from the actions of alternative A would add little to the regional cumulative effects on water quality compared to the disturbance occurring in other parts of the region.

Both allotments in the national memorial drain into the San Pedro River in either the United States or Mexico. The Arizona Department of Environmental Quality monitors water quality in the San Pedro River at a station approximately 9 miles east of the memorial and less than 4 miles north of the international boundary. The Environmental Protection Agency has classified portions of the San Pedro River between the Mexico border and Charleston Arizona as impaired under section 303d of the Clean Water Act because of turbidity levels that exceed water quality standards (AZ Dept. of Env. Qual. 1998). Over five years, 10%–25% of the samples taken exceeded the turbidity standard for the designated uses of aquatic life, wildlife, full body contact, and agriculture irrigation/ livestock water. However, the sources have been attributed to natural processes and grazing outside Arizona's jurisdiction.

The paths that have been created near the smuggling route for undocumented aliens and illegal drugs would continue to adversely affect riparian habitats through trampling of vegetation and increased erosion. This, coupled with the adverse impacts from grazing, would continue under alternative A, cumulatively affecting riparian habitat and consequently water quality.

Conclusion. Current memorial maintenance and operation actions would continue to result in a gradual, long-term beneficial impact on the memorial's water quality.

Removing the Montezuma Ranch structures would not measurably affect water quality because the action would not be near drainages, and mitigative measures would be used to contain or reduce soil erosion. Restoration of the site would offset any adverse effects of the removal.

Reducing livestock numbers consistent with the *Livestock Management Plan* is improving water quality by reducing sedimentation, fecal coliform, and other microbes, but grazing, even at reduced levels, would continue to degrade watersheds, This would cause soil erosion, decrease plant cover, and alter plant communities. The long-term adverse effects on water quality from continued grazing would be minor.

Wildlife

Analysis. Under alternative A, allowing the ranch structures to deteriorate would have no effect on wildlife species in the memorial. If the structures are removed, the activities associated with structural removal, such as the use of large trucks and the potential for ground disturbance, could adversely affect wildlife species in that location. Mobile animals would move to similar habitat during removal, but slow or sedentary animals might be lost. There would be negligible effects on common or highly mobile animal species (such as rabbit and deer) from the removal; however, the effects from removing the structures would be greater on populations of slow or sedentary rare or uncommon species known to have occupied the ranch area.

A 1998 survey found the secretive underground-dwelling desert shrew, uncommon in the memorial. Uncommon species of amphibians and reptiles occurring in the ranch area (barred tiger salamander, Madrean alligator lizard, short-horned lizard, prairie lizard, great plains skink, and blackneck garter snakes) also would be adversely affected by a loss of habitat or individuals, and individuals of rare or uncommon species might be lost from the memorial. With mitigative measures to reduce the adverse effects on these rare species, the overall short-term effect from removing the ranch structures would be negligible to minor. These activities would not be expected to result in any effect at the population or community level.

The adverse effects associated with the removal of structures at the ranch would be offset by restoration efforts that would restore natural wildlife habitat in the area. After structure removal, restoring the area to natural contours and revegetating it would improve grassland habitat, which would benefit wildlife species. An increase in rodent species in the memorial from 1978 was attributed to an increase in grasses and grass seed, which is favorable to small rodents. The increase in numbers and diversity of small rodents also has led to an increase in western diamondback rattlesnakes (Swann et al. 2000). Because only about 25 acres would be affected, the long-term beneficial effects on wildlife would be negligible.

The impacts on wildlife from cattle grazing are being reduced from pre-plan conditions by the recent implementation of the *Livestock Management Plan* (NPS 2000b). However, continued grazing in both allotments under this no-action alternative would continue to have adverse localized effects on wildlife, albeit at lower levels than occurred in the past. Compared to ungrazed conditions, ongoing effects from cattle grazing would include:

- Decreased availability of vegetation as a food source for wildlife as forage plants continued to be consumed by cattle.

- Changes in the composition of bird communities (Bock and Webb 1984, Bock et al. 1984). Ground-nesting birds would continue to be limited by the absence of suitable habitat because cover vegetation had been eaten or trampled by cattle.

Changes in the composition of lizard species (Bock, Smith, and Bock 1990).

Decreased productivity of grasshoppers (Jepson-Innes and Bock 1989), which are an important food source for many wildlife species.

Reduced plant cover would favor wildlife species adapted to open habitats. Although grazing probably would not directly eliminate wildlife species, population densities would be lower than those occurring in an ungrazed situation. Habitat generalists and species associated with disturbed or early seral conditions would be favored. The effect on wildlife communities from grazing under the no-action alternative would be minor, adverse, and long term.

Cumulative Effects. A fence built by the U.S. Border Patrol at the southern edge of Coronado National Memorial, newly installed lighting, and improvements to the dirt road there would have the potential to affect wildlife migration, access to water, and the movements of nocturnal species in local areas. Changes in the road would make travel at greater speeds possible, posing a threat to wildlife by collision. This project could adversely affect wildlife in the memorial, especially larger species adapted to moving over large tracts of land. Implementing alternative A would not contribute cumulatively to the adverse effects of the Border Patrol project.

Development, grazing, and loss of habitat in areas adjacent to the national memorial and in the San Pedro River valley might result in the loss of more wildlife species from the memorial, as has been documented for other western units of the national park system. The construction of roads in nearby areas would increase the number of accidental wildlife deaths and continue to fragment wildlife habitat. Timber harvesting in the adjacent Coronado National Forest would reduce available wildlife habitat. Hunting in the adjacent Coronado National Forest would remove small numbers of animals.

National parks have become vulnerable to poaching or collecting of valuable wildlife. Recent arrests of snake poachers in Arizona indicate that snakes are being collected in Chiricahua National Monument and Coronado National Memorial, but collecting in the national memorial appears to be infrequent and not to be affecting the memorial's reptile populations (Swann, Edwards, and Schwalbe 1999). The poaching of rare species, combined with the adverse effects of removing the Montezuma Ranch, would result in cumulatively adverse impacts on these populations in the memorial and regionally.

Conclusion. Removing the Montezuma Ranch structures and restoring and revegetating the area would result in more ground cover and habitat for small rodent species. The structure removal would cause short-term negligible adverse effects on wildlife. Mitigating measures would be used to prevent or reduce the effects on rare or uncommon wildlife species. Restoring and revegetating the site with native vegetation after the structures were removed would offset the adverse impacts on soils and improve grassland habitat, benefiting wildlife species.

Ongoing implementation of the *Livestock Management Plan* is improving wildlife habitat in the two allotments. However, continued grazing in the national memorial would result in minor long-term adverse impacts on some wildlife species from habitat loss and forage reduction.

Impairment

The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific

purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to air quality, cave resources, soils; vegetation; threatened, endangered, or sensitive species; water quality; or wildlife would result from implementing alternative A.

ALTERNATIVE B

Air Quality

Analysis. In alternative B, two kinds of action would adversely affect air quality:

(a) ground disturbance from restoration/revegetation efforts or from construction and road and trail improvements, either of which would result in wind-borne dust caused by the loosening of soils, which would produce occasional fugitive dust

(b) emissions produced by auto traffic and construction equipment

Vehicular emissions are transient, and no parameters in excess of established air quality criteria have been recorded in Cochise County. The increased visitation and the short-term presence of construction equipment that would occur under alternative B would not be likely to result in measurable changes to local air quality. Both the dust from ground disturbance and the emissions would result in negligible short-term transient effects on local air quality.

Cumulative Effects. Implementing projects and plans at the national memorial would not adversely affect air quality, which would be more likely to be affected by local development and pollution from distant sources than by the memorial's management activities. The construction activities and increased traffic of alternative B would contribute negligibly to transient local effects on air quality and would not affect regional air quality.

Conclusion. The construction activities and increased traffic from more visitation in alternative B would cause negligible local short-term adverse effects on local air quality at the memorial but would not affect regional air quality.

Cave Resources

Analysis. There are a number of caves in the national memorial, with Coronado Cave being the most prominent and accessible (0.75 mile from the visitor center). This has resulted in a visitation, by permit, of between 5% and 6% of the people that currently come to the memorial. The cave contains various limestone formations (stalactites, stalagmites, flowstone, and helicites) and provides habitat for animals. Occasionally visitors might cause slight damage to cave resources. In any one year, the damage results in negligible to minor adverse effects on cave resources. Developing a carrying capacity for Coronado Cave would result in the establishment of a monitoring system that would measure any loss of cave resources so that corrective measures could be taken. However, the loss of resources year after year could eventually result in minor long-term adverse effects on cave resources.

Cumulative Effects. The opening of Kartchner Caverns State Park about 35 miles north of the memorial has increased the interest of the visitors in caves. This interest added to the accessibility of Coronado Cave has resulted in a slight increase in visitation to the memorial's cave. This increased interest in caves has resulted in a slight loss of sensitive cave resources in the area of Cochise County.

Conclusion. There would be beneficial effects on Coronado Cave. The intensity of these effects would be difficult to quantify before the carrying capacity is determined, but

the effects would be long term and probably would be negligible to minor.

Soils

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect soil resources. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on soil resources such as the creation of social trails or paths. Overall, a long-term negligible beneficial effect on soils could result from these programs.

Alternative B would involve ground disturbance for building an annex to the visitor center, adding parking, pullouts, and new trails and trailheads. The annex and parking area would be developed in a previously disturbed area where soil susceptibility to erosion is low. Construction activities associated with developing up to three new pullouts and waysides would result in the loss of soil through compaction and wind and water erosion. There would be short-term impacts on soils during construction. The long-term effects of these developments would be negligible to minor, considering the small size of the area affected, the low erosion potential of the areas, and the use of mitigative measures.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of soils from erosion and compaction. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on soils would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Developing three trails in the grassland area north of the main road would disturb the Gardencan complex soils with erosion potentials ranging from low to moderate (see table 10, p. 90). The soils in the area that would be used for the accessible trail to be developed in the picnic area have a low erosion potential and moderate slopes. (Accessible trails must be at least 36 inches wide to accommodate wheelchairs and have turning areas of 60 inches wide every 200 feet.) The need to construct areas of the trail that would cross a drainage with a shallow slope for the creation of a ramp might necessitate routing the trail so that it would not rise or fall too steeply when crossing a drainage. This would reduce the impacts on soils. Where possible, the footprint of one of the existing trails or social trails would be used to develop the new accessible trail. Soil erosion would increase on and along the edges of these trails from visitor use. Development and visitor use of new trails would result in soil erosion and compaction, but the long-term effects would be negligible to minor because the locations have been previously disturbed, soil erosion potentials are low, and best management practices would minimize the impacts.

Removing the Montezuma Ranch structures under alternative B, reestablishing the natural contours, and revegetating the area with native species would result in effects on soils similar to those described for alternative A.

Restoring and revegetating East Forest Lane and the area where powerlines would be removed would benefit soils in the national memorial; that is, revegetation would improve soil properties by reducing soil compaction and increasing permeability. Revegetation also would result in the development of root systems, which would hold soils in place. The total area revegetated would directly affect less than 50 acres of soils. Restoring these sites

and Montezuma Ranch would result in long-term negligible to minor beneficial effects on soil resources.

Eliminating grazing from the national memorial would reduce some soil erosion and compaction and improve permeability. Furthermore, it would reduce the disturbance of soils and vegetation in the riparian areas and along dry streambeds in the allotments, which would reduce the amount of sediment being added to the stream channel. The beneficial effects on soils from eliminating grazing in the memorial would be long term and minor.

Cumulative Effects. The ground-disturbance associated with development under alternative B would affect less than 1% of the soils in the memorial. These adverse impacts would add cumulatively to the adverse impacts associated with illegal drug trafficking and immigration in the national memorial. Eliminating grazing on the allotments would result in a beneficial effect on 1,811 acres of soils in the national memorial. Restoring previously disturbed soils would offset any adverse effects associated with development.

Coronado National Memorial is on a smuggling route for undocumented people and illegal drugs. The illegal entry across the United States border into the memorial has resulted in soil compaction and erosion resulting from the development of numerous footpaths. In addition, soils in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Visitor use results in soil compaction and erosion along existing trails and the creation of social trails that results in uprooting and damage to vegetation in the local area. These activities, along with the development of additional employee housing, would result in negligible to minor adverse impacts on soils and vegetation throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Cochise County plans for increased growth in the Southern San Pedro Valley, with some restrictions on the scale and density of the development. Grazing occurs on private lands and in the Coronado National Forest adjacent to the national memorial. The beneficial effects on soils from alternative B would have little cumulative effect on a regional scale when compared to adverse effects offering to soils from increasing urban development and from agriculture in areas surrounding the national memorial.

Conclusion. Expanding the visitor center and adding parking, pullouts, and new trails and trailheads would affect less than 1 acre of soils, and mitigative measures would be used. These overall effects would be negligible to minor because of the small size of the area affected, the low erosion potential of the soils, and the implementation of mitigation measures.

Removing the Montezuma Ranch structures would erode and compact soils. The local adverse impacts on soils would be short-term and negligible to minor because mitigative measures would be employed to minimize erosion and limit construction activities to the immediate area. The adverse effects would be offset by beneficial effects from restoring and revegetating the site, which would improve the ecosystem's health and integrity by reducing nonnative vegetation and increasing the number of native species, a negligible to minor long-term beneficial effect. This alternative would reduce soil compaction and increase permeability and soil retention, a long-term negligible to minor beneficial effect on soil resources.

The development of new employee housing would result in long-term negligible to minor

adverse effects on soils, and mitigation measures would be employed to reduce erosion. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to soils in the memorial.

Eliminating grazing from the memorial would result in long-term minor beneficial effects on soils by reducing nonnative species and reestablishing native vegetation. Overall, the beneficial effects of this alternative would offset any adverse impacts associated with development.

Vegetation

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect vegetation. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on vegetative communities such as the creation of social trails. Overall, a long-term negligible beneficial effect on vegetation could result from these programs.

Less than 1 acre of oak-Mexican piñon-juniper woodland association would be disturbed by the construction of the visitor center annex and added parking; this association accounts for 3,363 acres of the memorial's vegetation. In the past, the vegetation in these areas has been fragmented and the integrity compromised on a small scale by the development of the visitor center and the picnic area. Therefore, these developments would result in long-term negligible to minor local adverse impacts, which would be mitigated by limiting maintenance activities to the immediate area and revegetating the areas after construction.

Expanding the pullout near the end of the main road to add a picnic area and wayside in part of the Montezuma Canyon drainage would disturb a small area of oak-Mexican piñon-juniper woodland association. The location of these pullouts has not been determined, but sensitive areas such as riparian habitat would be avoided. The amount of vegetation affected by these pullouts would be small in relation to the size of the memorial. Associated construction activities would result in a long-term loss of vegetation through trampling and uprooting. The overall effects of these developments and up to three new pullouts and waysides and would be negligible to minor because the affected areas would be small and mitigative measures would be used.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of vegetation from erosion and compaction as well as from the uprooting and loss of individual plants. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on vegetation would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Developing four new trails and trailheads, some with restrooms, with three trails being in the grasslands, would affect less than 1% of the total grassland habitat in the national memorial, which constitutes 22% of the memorial's total vegetation. The grasslands have been disturbed in the past by grazing, and one trail would use the existing footprint of the Windmill Road. Developing an accessible trail in oak-Mexican piñon-juniper woodland association of the picnic area would affect less than 1% of this type of vegetation. Widening the trail to comply with accessibility requirements would necessitate removing vegetation and would compact more soils.

The widening and hardening of trails for accessibility would result in the compaction of soils and the loss of riparian vegetation where trails cross drainages. The local adverse effects of all trail development would be minor because the areas have been previously disturbed, and the effects throughout the memorial would be negligible because the affected area would be small.

Removing the Montezuma Ranch structures, reestablishing the natural contours, and revegetating the area with native species would result in effects on soils and vegetation similar to those described for alternative A.

Restoring and revegetating East Forest Lane, which crosses an ephemeral streambed, and removing powerlines along the Montezuma Pass road would affect vegetation in the mixed grasses and oak-Mexican piñon-juniper woodland and the honey mesquite–mixed short-tree woodland associations. Removing nonnative species and restoring native vegetation adjacent to a larger intact vegetative community would help to restore overall vegetative integrity and ecosystem health. Restoring these sites and Montezuma Ranch would affect less than 50 acres of vegetative habitat; therefore, the long-term beneficial effects would be negligible to minor.

Eliminating grazing from the national memorial might reduce the potential for nonnative species to invade and spread, which could occur by seeds being dispersed in fur and dung, by soils being disturbed (which creates conditions favorable to weedy species and reduces the potential for the establishment of native species) and by cattle consuming native species, reducing competition (Fleischner 1994). Ending grazing also might improve cover and the density of plants, especially warm season grasses. This would result in long-term minor beneficial effects on vegetation.

In addition, eliminating grazing from the memorial would result in a long-term gradual shift in forage plant species from a community dominated by less palatable species to one with predominantly palatable species. The availability of water would allow riparian areas in the grazing allotments to recover sooner than upland areas. Soil erosion in allotment areas would be reduced over time because of an increase in vegetation and plant litter. Noticeable improvements in range condition would take 25 to 50 years because soils and vegetation recover slowly in arid environments. The long-term beneficial effect on range condition from ending grazing in the memorial would be minor.

As described in the "Affected Environment" chapter, the studies of the effects of grazing on agave plants are conflicting. Two studies found that the trampling of young plants and eating of flowering stalks by cattle are detrimental to agave populations (Martinez-Morales and Meyer 1985; Hodgson and DeLemater 1988). However, a study conducted in the memorial found no difference between the allotment that continues to be grazed and the one that has not been grazed since 1990 (Hawks 1997). This was attributed to the predation of agaves by native herbivores, including white-tailed deer, in the ungrazed area. Bock et al. (1984) found that grass cover was substantially higher in an area excluded from grazing than in grazed areas. Brady et al. (1989) found no difference in plant cover within grazing exclosures, but reported significantly higher cover of tall grasses such as plains lovegrass.

Cumulative Effects. The encroachment of woody species throughout grasslands in the upper San Pedro Basin is a factor in regional decreases in the amount and ecological functioning of native grasslands and in their fragmentation into small, disconnected patches. Urban development in the region also has resulted in a loss of grassland acreage. Another regional issue is the intrusion of nonnative plant species. Fort Huachuca and Coronado National Forest are trying to prevent the introduction of such species and control their spread. Fort Huachuca is con-

ducting experimental investigation and treatments of Lehmann lovegrass. Ending grazing in the national memorial would benefit the grassland habitat, and restoring native species under alternative B would benefit vegetation. However, the actions of alternative B would not offset the loss of grasslands from development or the invasion of nonnative plants in the region, and implementing the alternative would contribute little cumulatively to regional effects.

Coronado National Memorial is on a smuggling route for undocumented people and illegal drugs. The illegal entry across the United States border into the memorial has resulted in soil compaction and erosion resulting from the development of numerous footpaths. In addition, vegetation in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Visitor use results in soil compaction and erosion along existing trails and the creation of social trails, which results in uprooting and damage to vegetation in the local area. These activities, along with the development of additional employee housing, would result in negligible to minor adverse impacts on soils throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Expanding the visitor center and adding parking, pullouts, and trailheads would affect less than 1 acre of vegetation, and mitigative measures would be used. The impacts would be negligible to minor because of the small size of the area affected, the low erosion potential of the soils, and the use of mitigation.

The development of new employee housing would result in long-term negligible to minor adverse effects on vegetation, and mitigation measures would be employed. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to vegetation in the memorial.

Removing the Montezuma Ranch structures would result in local adverse impacts on vegetation, which would be short term and negligible to minor because mitigative measures would be used to minimize soil erosion, limit construction activities to the immediate area, and accelerate restoration of native plant species. The adverse effects would be offset by beneficial effects from restoring and revegetating the site, which would improve the ecosystem's health and integrity by reducing nonnative vegetation and increasing the number of native species, a negligible to minor long-term beneficial effect.

Ending grazing in the memorial would result in long-term minor beneficial effects on vegetative communities and range condition by reducing nonnative species and reestablishing native vegetation. Overall, the beneficial effects of this alternative would offset any adverse impacts associated with development.

Threatened, Endangered, or Sensitive Species

Analysis. The knowledge gained through establishing an inventory program would enable NPS personnel to better protect sensitive resources such as threatened and endangered species. Educating the public through new interpretive materials could help to reduce the adverse impacts on resources that sensitive species rely on. Overall, developing interpretive programs would result in a beneficial effect on threatened, endangered, or sensitive species.

Expanding the visitor center and adding hiking trails, parking lots, and pullouts would not directly affect federally listed or sensitive species in the memorial. The development-related activities of alternative B would not affect the roosting sites of lesser long-nosed bats or Mexican long-tongued bats. Those activities might indirectly affect listed or sensitive species by disturbing prey species and vegetation. With mitigation to transplant agaves in construction sites (to prevent the loss of important food sources for nectar-feeding bats), the development activities of alternative B would not be expected to alter the population of agave plants. Because the area disturbed would be minimal and construction activities would be short-term, there would be no measurable effect on small mammal populations in grassland habitats, which are the prey base of the loggerhead shrike. Therefore, implementing alternative B might indirectly affect the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike but would not be likely to adversely affect these species.

Developing trails in the grassland areas at lower elevations would be unlikely to affect Mexican spotted owls because these grasslands and scrub areas lack suitable habitat for nesting and have relatively low prey density and biomass. Expanding the visitor center parking lot, developing a new trail near the current picnic area, upgrading the interpretive trail near the visitor center, and developing new housing would take place in pine-oak-juniper forests that are potential foraging habitat for the owls. Developing and expanding recreational facilities in this area might alter the foraging habitat and the use of this habitat by the owl (USFWS 1995b). However, since these developments would take place in previously disturbed areas that are frequently used by visitors, it is likely that the owls avoid this area when foraging. The effects on owl foraging habitat outside protected activity centers from development would be short-term, indirect, and negligible, and the species would not be likely to be adversely affected.

Removing the Montezuma Ranch structures and restoring the area would result in long-term indirect minor beneficial effects on threatened, endangered, or sensitive species similar to those described for alternative A. Long-term indirect minor beneficial effects would result from increasing the prey habitat of the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike. The ranch area is not in prime owl foraging or nesting habitat; therefore, removing the ranch buildings would not adversely affect the Mexican spotted owl.

Restoring and revegetating East Forest Lane might increase loggerhead shrike habitat and the shrike's prey species (small mammals, insects, and reptiles), a long-term benefit for the shrike. Revegetating the road also might establish more agave plants, which would have a beneficial effect on the agave population and subsequently the nectar-feeding bats. However, the area involved would be only a small part of the memorial; therefore, these restoration activities would not be likely to adversely affect the lesser long-nosed or Mexican long-tongued bat or the loggerhead shrike; rather, they would cause negligible to minor beneficial effects.

Part of the powerline that parallels the road to Montezuma Pass is in the proposed protected activity center for Mexican spotted owls. The powerline to be removed and revegetated is in the pine-oak-juniper forest, which is foraging habitat for the owl. Removing the powerline could result in short-term indirect negligible effects resulting from human presence and activity, which probably would cause owls to avoid the area. Restricting the powerline removal activity in the protected activity center during the breeding season would mitigate these effects. However, revegetating the area would produce a negligible to minor benefit for the species by increasing habitat available for its prey species. Any short-term disturbance of the owls' foraging habitat

caused by removing the powerline would be offset by the benefits.

Eliminating grazing in the memorial might increase the prey base and nesting habitat for the loggerhead shrike. Bock et al. (1984) found a negative correlation between grazing and overall rodent densities in desert environments, and studies in the memorial have shown that increased grassland habitat resulted in increases in small mammal diversity and in their predators such as the western diamondback rattlesnake (Swann, Alberti, and Schwalbe 2001). Studies by Hawks (1997) in Coronado National Memorial showed that grazing had little effect on agave populations, or the predation of flower stalks of Palmer's agave, which are an important food source for nectar-eating bats. Therefore, eliminating grazing probably would have a negligible effect on the long-nosed bat.

Alternative B would not be likely to adversely affect the endangered lesser long-nosed bat.

Because the grazing allotments lack suitable habitat for Mexican spotted owls, higher energy costs are necessary to reach the allotments, and the allotments have relatively low prey density and biomass, it is unlikely that the owls use the allotments. Ending grazing in the memorial would not be likely to adversely affect Mexican spotted owls.

Cumulative Effects. Efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Natural areas adjacent to the memorial such as the national forests, the national conservation area, and state parks offer interpretive programs and provide visitor information related to the unique natural environment found in the region. These programs along with enhanced interpretation and inventorying of memorial resources that enhance public awareness and understanding of the natural environment would benefit all natural resources.

A loss of trees in the memorial and the resultant growth of high elevation grasses since the wildfires of 1988 have resulted in an increase in rodent species, which has increased the availability of prey for the loggerhead shrike, a minor beneficial effect for the shrikes and their prey. Eliminating grazing under alternative B would increase grassland habitat and small mammal habitat, which would increase the prey abundance for the shrike. Ending grazing in the memorial, combined with the effects of the past fire, would result in a minor cumulative benefit to the loggerhead shrike.

As has been mentioned, wildfire is the primary threat to the persistence and recovery of the Mexican spotted owl (USFWS 1995b). The loss of owl habitat in the memorial from the 1988 wildfire, together with the potential for future catastrophic fire, represents a moderate to major threat to this species. Limiting the removal of powerlines in the proposed protected activity center to a time not in the owl's breeding season would cause negligible effects on the species. This activity, combined with habitat loss from wildfire, would cause moderate to major effects on the Mexican spotted owl. Actions to reduce hazardous fuel loads in Coronado National Forest, which would be identified in a future fire management plan and are currently underway on Fort Huachuca, would cumulatively benefit the owls by reducing the likelihood of habitat alteration.

The restoration of grassland on Fort Huachuca is improving the ecological integrity and function of native grasslands. Prescribed burns on private and public lands are being used to maintain grasslands, which might increase the region's agave population, a minor to moderate benefit for nectar-feeding bats in the region. Alternative B would make a negligible contribution to these beneficial effects on grasslands and nectar-feeding bats. The overall beneficial cumulative effect on listed and sensitive bat species in the region would range up to moderate.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits to threatened and endangered or sensitive species in the memorial.

Enlarging the visitor center and adding trails, parking areas, and pullouts would cause indirect effects on lesser long-nosed bats, Mexican long-tongued bats, and loggerhead shrikes by disturbing vegetation and small mammals that are food sources for the shrikes. The developments would not measurably affect the population of agaves, a food source for the lesser long-nosed bat and the Mexican long-tongued bat, nor would it alter the populations of small mammals in grassland habitats, which are the prey base of loggerhead shrikes.

The development activity near the visitor center would occur in pine-oak-juniper forests that is primary foraging habitat of the Mexican spotted owl. These actions would take place in areas previously disturbed and frequently used by visitors. The owls often avoid those areas. The developments in owl foraging habitat outside the protected activity center would be short-term, indirect, and negligible and would not be not likely to adversely affect the species.

Removing the Montezuma Ranch structures would disturb about 25 acres (less than 1% of the memorial's acreage), causing negligible to minor adverse effects on the food base of the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike. Therefore, removing the structures might indirectly affect but would not be likely to adversely affect those listed or sensitive species. The ranch area is not in prime foraging or nesting habitat for the Mexican spotted owl, and there is low availability of the owl's prey species in this location; therefore, removing the ranch structures would not be likely to adversely affect this species.

Restoring and revegetating the ranch area after removing the structures might increase the number of agave plants, resulting in more available food for nectar-feeding bats. Revegetating the area probably would increase the habitat and prey species of the loggerhead shrikes. Thus, there would be beneficial effects on the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike, and the restoration would not be likely to adversely affect these species. Because only a small part the memorial would be affected, this alternative might affect the lesser long-nosed and Mexican long-tongued bats and the loggerhead shrike but would not be likely to adversely affect these species.

It is unlikely that Mexican spotted owls use the grazing allotments; therefore discontinuing grazing would likely not affect these owls.

Alternative B would not be likely to adversely affect the endangered lesser long-nosed bat.

Eliminating grazing from the memorial might increase the prey base and nesting habitat for loggerhead shrike. It would have a negligible effect on the lesser long-nosed and Mexican long-tongued bat.

Water Quality

Analysis. Better protection of soils and vegetation through a monitoring program would lead to better protection of water quality, an overall beneficial effect on water quality under this alternative. Developing new employee housing would not affect riparian habitat, and mitigative measures would include actions to minimize erosion by stabilization with structures or vegetation. Therefore, there would be no adverse impact on water quality from building new housing.

The short-term effects on water quality from constructing the visitor center annex and a new parking area would negligible because the construction would not be in riparian habitat,

and best management practices would be used to reduce soil erosion into the adjacent environment and to limit construction activity to the immediate area. Expansion of an existing pullout near the end of the park road would provide for a picnic area and wayside and would occur along a small portion of the Montezuma Canyon drainage. Two more pullouts would be developed to take advantage of park views, however the location of these is undetermined. The construction-related activities would result in increased soil erosion and a loss of vegetation in the riparian area. The area affected by pullout development would be small and mitigated by measures to limit erosion through structures or revegetation of the area. The short-term effects on water quality of these developments would be localized and negligible to minor and would lessen with the reestablishment of streambank vegetation after construction.

Developing four new trails, with one trail, including part of the old Windmill Road, widened and hardened for accessibility, would result in the compaction of soils, with a short-term increase in soil erosion and sedimentation into the streambed during construction. It also would cause a loss of riparian vegetation where trails cross drainages. Parts of two accessible trails would cross drainages and might need to be adjusted for slope requirements, which would reduce soil erosion in the riparian habitat. Because an existing footprint would be used for parts of the trails and mitigating measures would be used to prevent trampling and the loss of riparian vegetation, the adverse effects on water quality from trail development would be limited, since the areas disturbed would be small.

Removing the Montezuma Ranch structures under alternative B, reestablishing the natural contours, and revegetating the area with native species would result in effects on water quality similar to those described for alternative A.

Restoring natural contours and vegetation in areas now occupied by abandoned powerlines in the Montezuma Canyon drainage would increase soil erosion, subsequently increasing stream sedimentation and turbidity. This would cause the loss of some riparian vegetation, a short-term adverse effect that would be offset by revegetating these areas. The long-term effects on water quality would be negligible because the affected area would be small. In addition, best management practices would be used to control soil erosion.

Reclaiming East Forest Lane, which crosses a drainage along its course, would increase riparian vegetation and decrease soil erosion and sedimentation into the adjacent drainage. Revegetating riparian areas and closing this road would result in minor beneficial long-term effects on water quality.

Eliminating grazing from the national memorial would end the livestock disturbance of soils and vegetation in riparian areas along dry streambeds, reducing streambank erosion and the amount of sediment being added to the stream channel. The long-term beneficial effects on water quality in the memorial would be minor.

Cumulative Effects. Recreation, cattle grazing, ranching, road construction, water diversion, and urban development in the region all cumulatively affect soils, vegetation, and riparian environments, and consequently water quality. Developing additional employee housing in the memorial would not contribute to the cumulative effects of these other activities occurring in the region.

Erosion and pollution control measures at Fort Huachuca and Coronado National Forest would reduce potential water quality impacts in the San Pedro River basin. Implementing alternative B at Coronado National Memorial would reduce erosion, consequently reducing a potential source of sediment and turbidity in the San Pedro River channels. The actions of alternative B also

would support the goals of the Upper San Pedro Partnership to manage drainages in the Upper San Pedro River basin so as to decrease erosion from runoff, adding cumulatively to the beneficial effects on water quality from actions by other public agencies.

Conclusion. No adverse effects on water quality would be anticipated from developing additional employee housing. The establishment of monitoring programs in the memorial to monitor activities such as grazing would benefit overall water quality in the memorial.

Adding an annex to the visitor center and developing new parking and pullouts would affect less than 1 acre, resulting in long-term negligible to minor adverse impacts on water quality. Mitigative measures would be used to reduce soil erosion and the loss of vegetation along streams.

Removing the Montezuma Ranch structures and restoring and revegetating the area would have negligible effects on water quality.

Restoring East Forest Lane and the site where powerlines would be removed would restore native riparian vegetation, reducing soil erosion and sedimentation. The long-term beneficial effects on water quality from those activities would be negligible to minor.

Ending grazing in the memorial would improve water quality by decreasing sedimentation and reducing fecal coliform and other microbes, a long-term minor beneficial effect on riparian habitats and water quality. Overall, the beneficial effects on water quality from this alternative would offset any adverse impacts associated with development.

Wildlife

Analysis. Through knowledge gained from an inventory and monitoring program, national memorial staff could better protect wildlife habitat. Educating the public with interpretive materials could reduce impacts on wildlife and habitat from visitor use. Overall, developing interpretive programs would result in a beneficial effect on wildlife.

The effects on wildlife in the memorial from expanding the visitor center, new employee housing, and adding a pullout near the end of the paved main road would be negligible for mobile species, but slow or sedentary species, particularly amphibians and reptiles, would be more susceptible to adverse effects from construction. Individuals of these populations might be lost. However, with mitigation to reduce impacts on rare or uncommon species, the short-term adverse effects on wildlife from alternative B would be negligible to minor.

The effects of roads and trails on wildlife are diverse. These effects include mortality, restricted movement, introduction of exotic plants (which could affect wildlife habitat), habitat fragmentation and edge effect, and increased human access to wildlife habitats (Colorado State Parks 1998, Forman 2000, Forman and Alexander 1998). Trails and roads in the memorial bring people into wildlife habitat. People hiking or driving along roads disturb wildlife species, and wildlife sometimes react to the presence of people or the noise of or their machines with an increased expenditure of energy, which could lead to increased mortality. Escape responses to human disturbance can be energetically "expensive" to wildlife for two reasons: feeding animals stop eating when disturbed, and disturbed animals use energy to run or otherwise move away from the disturbance (Colorado State Parks 1998, Knight and Gutzwiller 1995).

Developing new trails in the grasslands where recreation activity has been minimal in the past might adversely affect some individual wildlife, family groups, or nesting colonies because of noise or passive disturbance by the presence of humans. Because survey data indicates a lack of rare or uncommon species and the area affected by trail development would affect a small portion of the wildlife

habitat available in the memorial, the impacts of trail use by visitors in these grassland areas would be negligible to minor. Some benefits to individual animals in the memorial might result from trail development. Animals such as mule deer and white-tailed deer might use the trails and roads to facilitate movement within the habitat. Ease of movement might benefit individuals of those species by reducing energy expenditures. The long-term benefits would likely be negligible.

Widening and paving Windmill Road to convert it to an accessible trail would result in negligible adverse effects on wildlife species. Developing an accessible trail in the picnic area would remove some wildlife habitat and displace of some species; however, the impact would be negligible because the area affected would be small.

Removing the Montezuma Ranch structures, reestablishing the natural contours, and revegetating the area with native species would result in effects on wildlife similar to those described for alternative A.

Restoring and revegetating East Forest Lane and removing the powerline along the main road would increase habitat and food for many species of small mammals, nesting birds, and reptiles, benefiting wildlife in the long term. Restoring the powerline area would improve oak woodland and riparian habitats, which would benefit rare and uncommon species such as Woodhouse's toad and the Sonoran Mountain king snake. East Forest Lane traverses many plant associations, grassland, oak woodland and riparian areas, so its restoration would benefit the prairie lizard, the big bend patchnose snake, and the Mojave rattlesnake. The areas restored would constitute only a small part of the national memorial; therefore, the long-term beneficial effects on wildlife would be negligible to minor.

Closing East Forest Lane to vehicles would decrease the potential for road kill and reduce the indirect effects of human presence, and revegetating the road would provide more continuous habitat for animal migration. The absence of the road would benefit larger animals in the memorial such as predators and deer. The wash draining the east slope of the memorial represents the best potential conduit for wildlife (Hass 2000); therefore, eliminating this road would result in a long-term negligible to minor beneficial effect on migrating species.

Eliminating grazing from the national memorial would reduce the impacts on soils and vegetation, benefiting some wildlife species by making more food and cover available. Ground cover would be increased, making more and better grassland available for bird nesting. The quality of habitat for most wildlife under alternative B would be better than under alternative A. Studies in the memorial have shown that more grassland habitat has led to an increase in small mammal diversity and in their predators, such as the western diamondback rattlesnake (Swann, Alberti, and Schwalbe 2001).

Ending grazing in the memorial might result in the loss of some species that prefer more open, desertlike habitat created by grazing. The coachwhip was the second most abundant snake species at Coronado in 1979 (Cockrum et al. 1979); however, in a recent survey, the species was found to be rare (Swann et al. 2000). The decline was attributed to a lack of grazing on the Montezuma allotment, which altered the habitat. The reduced impact on riparian vegetation would increase cover and nesting habitat, beneficially affecting species such as migrating birds, deer, and predators that use the drainages on the allotments as corridors. Overall, eliminating grazing under alternative B would result in minor long-term beneficial effects on wildlife.

Cumulative Effects. Grassland restoration in Fort Huachuca is being used to improve the ecological integrity and function of native grasslands, and prescribed burning on private and public lands in the area is used to maintain grasslands. The actions of alternative

B would contribute cumulatively to these regional beneficial effects on grasslands.

In combination with forest conservation actions in the isolated mountains of southeastern Arizona and in the San Pedro River National Conservation Area, the actions of alternative B would benefit both migratory birds and larger, dispersing animals that require more forest habitat to sustain viable populations. The Upper San Pedro Valley is a major neotropical migrant bird corridor. Woodlands and forest habitats in the Huachuca Mountains and in the San Pedro River National Conservation Area are important habitat resources for migrating birds.

Proposed management actions at Fort Huachuca and activities in the Coronado National Forest (such as snag and nest tree protection and wildfire management) would sustain biologically and structurally diverse habitat for migrating or dispersing wildlife in the Huachuca Mountains. The actions of alternative B would complement these efforts to maintain wildlife corridors and riparian areas and conserve native grasslands.

Developments by the border patrol to improve roads and install fencing and lighting adversely affect wildlife by impeding movement, altering feeding patterns, and reducing habitat quality for nesting and feeding. Development, grazing, and loss of habitat in areas adjacent to the national memorial and in the San Pedro River valley might result in the loss of more wildlife species from the memorial. Timber harvesting and hunting in the adjacent Coronado National Forest would reduce available wildlife habitat, alter animal behaviors, and results in the removal of individuals. Although thought to be rare in the memorial, poaching of reptiles and amphibians results in a loss of individuals and may reduce populations of rare or uncommon species in the region. Development within the national memorial including new employee housing which would result in the loss of a small portion of wildlife habitat would contribute negligibly to the adverse cumulative effects of these other regional activities.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial that enhance public awareness of the natural environment help to protect sensitive areas such as riparian areas. Protection of these areas conserve wildlife habitat and benefit wildlife within the region.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits on threatened and endangered or sensitive species in the memorial. Loss of a small portion of wildlife habitat and the potential for loss of sedentary individual animals from development of new employee housing would have long-term negligible to minor adverse effects.

Expanding the visitor center and building trails would result in more public access to wildlife habitat, resulting in negligible to minor adverse effects. Trails and roads might benefit some species by facilitating movement.

Removing the Montezuma Ranch structures, with mitigating measures to reduce impacts on rare or uncommon species, would result in long-term negligible adverse effects on wildlife. Restoring the ranch area to natural contours and revegetating it would improve grassland habitat, resulting in a long-term negligible to minor benefit for wildlife species. Ending grazing in the national memorial would improve habitat and forage, benefiting wildlife.

Impairment

The resources and values of Coronado National Memorial would not be impaired

because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to air quality; cave resources, soils; vegetation; threatened, endangered, or sensitive species; water quality; or wildlife would result from implementing alternative B.

ALTERNATIVE C

Air Quality

Analysis. Limited amounts of fugitive dust would be generated in alternative C by restoration and revegetation activities, upgrading the interpretive trail, and renovations at the visitor center. This would not affect visitors or staff to a notable degree. Visitation and traffic would continue to increase at current rates. The short-term adverse effects on air quality from these activities would be negligible and localized. Other plans and management activities of the national memorial would not adversely affect air quality.

Cumulative Effects. Population growth and development outside the national memorial would be more likely to affect air quality than the management activities of the memorial. In addition, emissions from Tucson and Mexico are carried to the memorial by prevailing winds. Alternative C, in conjunction with other actions, would contribute negligibly to short-term local adverse effects on air quality but would not affect regional air quality.

Conclusion. The construction activities and increased traffic from more visitation in alternative C would cause negligible local short-term adverse effects on local air quality at the memorial but would not affect regional air quality.

Cave Resources

Analysis. There are a number of caves in the national memorial, with Coronado Cave being the most prominent and accessible (0.75 mile from the visitor center). This has resulted in a visitation, by permit, of between 5% and 6% of the people that currently come to the memorial. The cave contains various limestone formations (stalactites, stalagmites, flowstone, and helicites) and provides habitat for animals. Occasionally visitors might cause slight damage to cave resources. In any one year, the damage results in negligible to minor adverse effects on cave resources. Developing a carrying capacity for Coronado Cave would result in the establishment of a monitoring system that would measure any loss of cave resources so that corrective measures could be taken. However, the loss of resources year after year could eventually result in minor long-term adverse effects on cave resources.

Cumulative Effects. The opening of Kartchner Caverns State Park about 35 miles north of the memorial has increased the interest of the visitors in caves. This interest added to the accessibility of Coronado Cave has resulted in a slight increase in visitation to the memorial's cave. This increased interest in caves has resulted in a slight loss of sensitive cave resources in the area of Cochise County.

Conclusion. There would be beneficial effects on Coronado Cave. The intensity of these effects would be difficult to quantify before the carrying capacity is determined, but the effects would be long term and probably would be negligible to minor.

Soils

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect soil resources.

Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on soil resources such as the creation of social trails or paths. Overall, a long-term negligible beneficial effect on soils could result from these programs.

Adding parking spaces for four buses or recreational vehicles in the picnic area would result in long-term negligible to minor impacts on soils in a previously disturbed area where the soils have a low susceptibility to erosion (see table 10, p. 90). Best management practices would be used to reduce or eliminate impacts.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of soils from erosion and compaction. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on soils would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Widening the interpretive trail and compacting soils to create a hardened surface for better accessibility would affect local soils. The long-term effects would be negligible to minor because the area affected would be small and the existing trail footprint would be used.

Removing the Montezuma Ranch structures, reestablishing the natural contours, and revegetating the area with native species under alternative C would result in effects on soils similar to those described for alternative A.

Reestablishing and restoring natural contours and vegetation in areas now occupied by abandoned powerlines, roads, the Montezuma Ranch structures, the former fiesta grounds, the dirt storage area, and social trails and nonhistoric structures would affect about 50 acres. Restoring and revegetating these sites would improve soil properties by reducing soil compaction and increasing permeability, and it would restore overall vegetative integrity and ecosystem health. Such restoration would result in larger areas of unbroken habitat for wildlife, the removal of nonnative species, and the development of root systems that would hold soils in place. The local long-term beneficial effects on soils would be negligible to minor.

Eliminating grazing from the national memorial under alternative C would result in effects on soils similar to those described for alternative B.

Cumulative Effects. The ground-disturbance associated with development under alternative C, similar to alternative B, would affect less than 1% of the soils in the memorial. These adverse impacts would add cumulatively to the adverse impacts associated with illegal drug trafficking and immigration in the national memorial. Eliminating grazing on the allotments would result in a beneficial effect on 1,811 acres of soils in the national memorial. Restoring previously disturbed soils would offset any adverse effects associated with development.

Coronado National Memorial is on a smuggling route for undocumented people and illegal drugs. The illegal entry across the United States border into the memorial has resulted in soil compaction and erosion resulting from the development of numerous footpaths. In addition, soils in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Visitor use results in soil compaction and erosion along existing trails and the creation of social trails that results in uprooting and damage to vegetation in the local area. These activities,

along with the development of additional employee housing, would result in negligible to minor adverse impacts on soils and vegetation throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Cochise County plans for increased growth in the Southern San Pedro Valley, with some restrictions on the scale and density of the development. Grazing occurs on private lands and in the Coronado National Forest adjacent to the national memorial. The beneficial effects on soils from alternative B would have little cumulative effect on a regional scale when compared to adverse effects offering to soils from increasing urban development and from agriculture in areas surrounding the national memorial.

Conclusion. The impacts on soil resources from development under alternative C, such as visitor parking and trails improvements, would be long term and negligible because of the limited amount of development, the small size of the area affected (less than 1 acre), and the low soil erosion potential of the areas affected. Mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Montezuma Ranch and other areas in the memorial would be restored and revegetated under alternative C than under the other alternatives. Restoring sites would improve soil properties by reducing soil compaction and increasing permeability, causing local long-term negligible to minor beneficial effects on soils.

The development of new employee housing would result in long-term negligible to minor adverse effects on soils, and mitigation measures would be employed to reduce erosion. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to soils in the memorial.

Ending grazing in the memorial would have a long-term minor beneficial effect on soils because nonnative vegetative species would be reduced and native vegetation would increase. Overall, the beneficial effects of alternative C would offset any adverse impacts associated with the limited development.

Vegetation

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect vegetation. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on vegetative communities such as the creation of social trails. Overall, a long-term negligible beneficial effect on vegetation could result from these programs.

Adding parking spaces for four buses or recreational vehicles in the picnic area would result in long-term negligible to minor impacts on vegetation in a previously disturbed area where the soils have a low susceptibility to erosion. Best management practices would be used to reduce or eliminate impacts.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of vegetation from erosion and compaction as well as from the uprooting and loss of individual plants. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking

lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on vegetation would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Widening the interpretive trail and compacting soils to create a hardened surface for better accessibility would affect local vegetation. The long-term effects would be negligible to minor because the area affected would be small and the existing trail footprint would be used.

Removing the Montezuma Ranch structures, reestablishing the natural contours, and revegetating the area with native species under alternative C would affect vegetation in ways similar to those described for alternative A.

Restoring natural contours and vegetation in areas now occupied by abandoned powerlines, roads, the Montezuma Ranch structures, the former fiesta grounds, the dirt storage area, and social trails and nonhistoric structures would affect less than 50 acres. Restoring and revegetating these sites would restore overall vegetative integrity and ecosystem health. It would result in larger areas of unbroken habitat for wildlife, the removal of nonnative species, and the development of root systems to hold soils in place. The local long-term beneficial effects on vegetation would be negligible to minor.

Restoring the Montezuma Ranch and roads would take place adjacent to a larger intact vegetative community, and the revegetation would help to restore overall vegetative integrity and ecosystem health. The resulting long-term beneficial effects would be similar to those described for alternative A.

Ending grazing in the national memorial would result in effects on vegetation and range condition similar to those described for alternative B.

Cumulative Effects. Similar to alternative B, the encroachment of woody species throughout grasslands in the upper San Pedro Basin is a factor in regional decreases in the amount and ecological functioning of native grasslands and in their fragmentation into small, disconnected patches. Urban development in the region also has resulted in a loss of grassland acreage. Another regional issue is the intrusion of nonnative plant species. Fort Huachuca and Coronado National Forest are trying to prevent the introduction of such species and control their spread. Fort Huachuca is conducting experimental investigation and treatments of Lehmann lovegrass. Ending grazing in the national memorial would benefit the grassland habitat, and restoring native species under alternative B would benefit vegetation. However, the actions of alternative B would not offset the loss of grasslands from development or the invasion of nonnative plants in the region, and implementing the alternative would contribute little cumulatively to regional effects.

Coronado National Memorial is on a smuggling route for undocumented people and illegal drugs. The illegal entry across the United States border into the memorial has resulted in soil compaction and erosion resulting from the development of numerous footpaths. In addition, vegetation in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Visitor use results in soil compaction and erosion along existing trails and the creation of social trails, which results in uprooting and damage to vegetation in the local area. These activities, along with the development of additional employee housing, would result in negligible to minor adverse impacts on soils throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including

the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Adding more visitor parking would result in long-term negligible effects on vegetation because the development would be limited and the area affected would be less than 1 acre. Mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

The development of new employee housing would result in long-term negligible to minor adverse effects on vegetation, and mitigation measures would be employed. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to vegetation in the memorial.

More areas in the memorial would be restored and revegetated under alternative C than under the other alternatives. The impacts from development under alternative C would be long term and negligible because of the limited amount of development and the small size of the area affected (less than 1 acre). Restoring sites would improve ecosystem health and integrity by reducing nonnative species and reestablishing native plant species, a long-term local negligible to minor beneficial effect on vegetation.

Eliminating grazing from the memorial would have a long-term minor beneficial effect on vegetation and range condition because nonnative vegetative species would be reduced and native vegetation would increase. Overall, the beneficial effects of this alternative would offset any adverse impacts associated with the limited development.

Threatened, Endangered, or Sensitive Species

Analysis. The knowledge gained through establishing an inventory program would enable NPS personnel to better protect sensitive resources such as threatened and endangered species. Educating the public through new interpretive materials could help to reduce the adverse impacts on resources that sensitive species rely on. Overall, developing interpretive programs would result in a beneficial effect on threatened, endangered, or sensitive species.

Adding parking for buses or recreational vehicles on previously disturbed land would affect only a small area in the memorial and would not measurably affect vegetation or wildlife in grassland habitat. Since these activities would not affect grassland vegetation or wildlife habitat; they would not disturb the food sources of the nectar-feeding bats or the loggerhead shrike and would not affect the roosting sites of lesser long-nosed bats or Mexican long-tongued bats. Therefore, these activities would not result in any direct effects on the lesser long-nosed bat, the Mexican long-tongued bat, or the loggerhead shrike.

The added parking facilities, the upgraded interpretive trail, and the housing development would be in pine-oak-juniper forests, potential foraging habitat of the Mexican spotted owl. The development and the expanded recreational facilities of alternative C might alter the foraging habitat and its use by the owl (USFWS 1995b). However, since these developments would take place in previously disturbed areas that are frequently used by visitors, it is likely that the owls avoid these areas when foraging. Therefore, the effects from the developments, which would not be in the proposed protected activity center, would be short-term, indirect, and negligible, and the species would not be likely to be adversely affected.

Removing the Montezuma Ranch structures and restoring the area would result effects similar to those described for alternative A. Long-term indirect minor beneficial effects would result from increasing the prey habitat of the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike.

Because the ranch area is not in prime owl foraging or nesting habitat, removing the ranch structures would not adversely affect the Mexican spotted owl.

Restoring and revegetating East Forest Lane would result in the same effects on the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike as those described for Alternative A. The structure removal probably would increase habitat and prey species for the loggerhead shrike and increase the number of agave plants, a food source of the nectar-feeding bats. These actions would not be likely to adversely affect these species but would result in long-term negligible to minor beneficial effects.

Removing the powerlines along the road to Montezuma Pass and revegetating the area would result in the same effects on the Mexican spotted owl as described for alternative B. Short-term indirect negligible effects could result from human presence and activity, which probably would cause the owls to avoid the area when foraging. However, revegetating the area would cause a negligible to minor benefit for the species by increasing available habitat for its prey. With mitigation to limit powerline removal to a time not in the owl's breeding season, this activity might affect but would not be likely to adversely affect this species.

Eliminating grazing from the memorial under alternative C would cause the same effects on threatened, endangered, or sensitive species as those described for alternative B. Ending grazing would not be likely to adversely affect the endangered lesser long-nosed bat. Because suitable nesting and foraging habitat for the Mexican spotted owl is lacking in the grazing allotments, it is unlikely that the owls use these areas. Therefore, stopping grazing in the memorial would not be likely to adversely affect this species.

Cumulative Effects. As in alternative B, efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Natural areas adjacent to the memorial such as the national forests, the national conservation area, and state parks offer interpretive programs and provide visitor information related to the unique natural environment found in the region. These programs along with enhanced interpretation and inventorying of memorial resources that enhance public awareness and understanding of the natural environment would benefit all natural resources.

A loss of trees in the memorial and the resultant growth of high elevation grasses since the wildfires of 1988 have resulted in an increase in rodent species, which has increased the availability of prey for the loggerhead shrike, a minor beneficial effect for the shrikes and their prey. Eliminating grazing under alternative C would increase grassland habitat and small mammal habitat, which would increase the prey abundance for the shrike. Ending grazing in the memorial, combined with the effects of the past fire, would result in a minor cumulative benefit to the loggerhead shrike.

As has been mentioned, wildfire is the primary threat to the persistence and recovery of the Mexican spotted owl (USFWS 1995b). The loss of owl habitat in the memorial from the 1988 wildfire, together with the potential for future catastrophic fire, represents a moderate to major threat to this species. Limiting the removal of powerlines in the proposed protected activity center to a time not in the owl's breeding season would cause negligible effects on the species. This activity, combined with habitat loss from wildfire, would cause moderate to major effects on the Mexican spotted owl. Actions to reduce hazardous fuel loads in Coronado National Forest, which would be identified in a future fire management plan and are currently underway on Fort Huachuca, would cumulatively benefit the owls by reducing the likelihood of habitat alteration.

The restoration of grassland on Fort Huachuca is improving the ecological integrity and function of native grasslands. Prescribed burns on private and public lands are being used to maintain grasslands, which might increase the region's agave population, a minor to moderate benefit for nectar-feeding bats in the region. Alternative C would make a negligible contribution to these beneficial effects on grasslands and nectar-feeding bats. The overall beneficial cumulative effect on listed and sensitive bat species in the region would range up to moderate.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits to threatened and endangered or sensitive species in the memorial.

Adding parking for buses and recreational vehicles would not affect the long-nosed bat, the Mexican long-tongued bat or the loggerhead shrike because these actions would not take place in the grassland areas of the memorial, where the predominant forage for these species is found. The developments would be placed in owl foraging habitat outside the protected activity centers, and they would be in areas already used by visitors, so it is likely that the owls avoid these areas when foraging. Therefore, the effects from the developments would be short-term, indirect, and negligible, and these species would not be likely to be adversely affected.

Removing powerlines in the proposed protected activity center for the Mexican spotted owl at a time not in the owl's breeding season might cause the owls to avoid the area when foraging but it would not adversely affect the species.

Removing the Montezuma Ranch structures would disturb a small area and might result in the loss of individual agave plants, the food base of the lesser long-nosed and Mexican long-tongued bat. The action also might displace prey species of the loggerhead shrike. Therefore, removing the structures might indirectly affect but would not be likely to adversely affect these listed or sensitive species. The ranch area is not in prime foraging or nesting habitat for the Mexican spotted owl, and there is low availability of the owl's prey species in this location; therefore, removing the ranch structures would not be likely to adversely affect the Mexican spotted owl.

Restoring and revegetating the ranch area after removing the structures might increase the number of agave plants, resulting in more available food for nectar-feeding bats. Revegetating the area probably would increase the habitat and prey species of the loggerhead shrikes. Thus, there would be beneficial effects on the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike, and the restoration would not be likely to adversely affect these species. Because only a small part the memorial would be affected, this alternative might affect the lesser long-nosed and Mexican long-tongued bats and the loggerhead shrike but would not be likely to adversely affect these species.

It is unlikely that Mexican spotted owls use the grazing allotments; therefore discontinuing grazing would likely not affect these owls.

Ending grazing in the memorial would have a negligible effect on nectar-feeding bats. but would not be likely to adversely affect these species.

Ending grazing in the memorial might increase the prey base and nesting habitat for loggerhead shrikes.

Water Quality

Analysis. Better protection of soils and vegetation through a monitoring program would lead to better protection of water quality, an overall beneficial effect on water quality under this alternative. Developing new employee housing would not affect riparian

habitat, and mitigative measures would include actions to minimize erosion by stabilization with structures or vegetation. Therefore, there would be no adverse impact on water quality from building new housing.

Adding parking spaces for four buses or recreational vehicles in an existing footprint would result in negligible effects on water quality because the development would not take place in riparian areas or adjacent to a stream channel.

The effects on water quality from removing the Montezuma Ranch structures, reestablishing the natural contours, and revegetating the area with native species would be similar to those described for alternative A.

Restoring abandoned roads, the dirt storage area, the former fiesta grounds, and social trails to natural contours and revegetating the areas would affect water quality in ways similar to those described for alternative B.

Ending grazing in the memorial under alternative C would result in effects on water quality similar to those described for alternative B.

Cumulative Effects. Similar to alternative B, recreation, cattle grazing, ranching, road construction, water diversion, and urban development in the region all cumulatively affect soils, vegetation, and riparian environments, and consequently water quality. Developing additional employee housing in the memorial would not contribute to the cumulative effects of these other activities occurring in the region.

Erosion and pollution control measures at Fort Huachuca and Coronado National Forest would reduce potential water quality impacts in the San Pedro River basin. Implementing alternative B at Coronado National Memorial would reduce erosion, consequently reducing a potential source of sediment and turbidity in the San Pedro River channels. The actions of alternative B also would support the goals of the Upper San Pedro Partnership to manage drainages in the Upper San Pedro River basin so as to decrease erosion from runoff, adding cumulatively to the beneficial effects on water quality from actions by other public agencies.

Conclusion. No adverse effects on water quality would be anticipated from developing additional employee housing. The establishment of monitoring programs in the memorial to monitor activities such as grazing would benefit overall water quality in the memorial.

The effects on water quality from adding a few more parking spaces in an existing footprint would be negligible because the area affected would be small, the actions would not take place in riparian habitat or adjacent to a stream channel, and mitigating measures would be used to reduce impacts.

Removing the Montezuma Ranch structures and restoring and revegetating the area would have negligible effects on water quality.

Restoring and revegetating more sites than in the other action alternatives would result in negligible to minor improvements in water quality by reducing sedimentation into drainages. Ending grazing in the memorial would result in a long-term minor beneficial effect on water quality**.** Overall, the beneficial effects of alternative C on water quality would offset any adverse impacts associated with the limited development.

Ending grazing in the memorial would improve water quality by decreasing sedimentation and reducing fecal coliform and other microbes, a long-term minor beneficial effect on riparian habitats and water quality. Overall, the beneficial effects on water quality from this alternative would offset any adverse impacts associated with development.

Wildlife

Analysis. Through knowledge gained from an inventory and monitoring program, national memorial staff could better protect wildlife habitat. Educating the public with interpretive materials could reduce impacts on wildlife and habitat from visitor use. Overall, developing interpretive programs would result in a beneficial effect on wildlife.

New employee housing would affect wildlife in that mobile animals would move during development to similar adjacent habitats, and slow or sedentary animals such as some reptiles, amphibians, and small mammals might be lost. For animal species that are common in the memorial, the construction would have negligible adverse effects. The rare or uncommon species that are slow or sedentary, particularly amphibians and reptiles, would be more susceptible to adverse effects from construction. However, with mitigating measures to reduce the potential loss of individuals of rare or uncommon species, the long-term adverse effects on wildlife would be negligible to minor.

Developing more parking spaces for buses and recreational vehicles would cause negligible adverse effects on wildlife similar to those described for alternative B, as would upgrading the interpretive trail and making it accessible.

Removing the Montezuma Ranch structures under alternative C would result in short-term negligible adverse effects on wildlife; reestablishing the natural contours and revegetating the area with native species would result in more ground cover and habitat for small rodent species, which with mitigation measures, would offset these adverse impacts in a manner similar to that described in alternative A.

Restoring and revegetating East Forest Lane and removing the powerline along the main road would increase habitat and food for many wildlife species. The long-term benefits to wildlife species from the restoration would range from negligible to minor, because the size of area that would be restored is small relative to the size of the memorial.

Ending grazing in the national memorial under alternative C would result in effects on wildlife similar to those described for alternative B.

Similar to the effects described in alternative B, eliminating grazing from the national memorial would reduce the impacts on soils and vegetation, benefiting some wildlife species by making more food and cover available. Ground cover would be increased, making more and better grassland available for bird nesting. The quality of habitat for most wildlife under alternative C would be better than under alternative A. Studies in the memorial have shown that more grassland habitat has led to an increase in small mammal diversity and in their predators, such as the western diamondback rattlesnake (Swann, Alberti, and Schwalbe 2001).

Ending grazing in the memorial, as described in alternative B, might result in the loss of some species that prefer more open, desertlike habitat created by grazing. The coachwhip was the second most abundant snake species at Coronado in 1979 (Cockrum et al. 1979); however, in a recent survey, the species was found to be rare (Swann et al. 2000). The decline was attributed to a lack of grazing on the Montezuma allotment, which altered the habitat. The reduced impact on riparian vegetation would increase cover and nesting habitat, beneficially affecting species such as migrating birds, deer, and predators that use the drainages on the allotments as corridors. Overall, eliminating grazing under alternative C would result in minor long-term beneficial effects on wildlife.

Cumulative Effects. The cumulative effects of alternative C on wildlife would be similar to those described for alternative B. These include the adverse effects of poaching and collecting in the memorial and on nearby

public lands, the effects on animal movement from the border patrol infrastructure project, the results of timber harvest in the Coronado National Forest, and increased grazing and roadbuilding on adjacent properties. Other cumulative effects would be the beneficial effects from the restoration of grasslands at Fort Huachuca and from the forest conservation actions in the mountains of southeastern Arizona and the Upper San Pedro Valley. Implementing alternative C would make a minor long-term contribution to local beneficial effects on wildlife species.

Developments by the border patrol to improve roads and install fencing and lighting adversely affect wildlife by impeding movement, altering feeding patterns, and reducing habitat quality for nesting and feeding. Development, grazing, and loss of habitat in areas adjacent to the national memorial and in the San Pedro River valley might result in the loss of more wildlife species from the memorial. Timber harvesting and hunting in the adjacent Coronado National Forest would reduce available wildlife habitat, alter animal behaviors, and results in the removal of individuals. Although thought to be rare in the memorial, poaching of reptiles and amphibians results in a loss of individuals and may reduce populations of rare or uncommon species in the region. Development within the national memorial including new employee housing which would result in the loss of a small portion of wildlife habitat would contribute negligibly to the adverse cumulative effects of these other regional activities.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial that enhance public awareness of the natural environment help to protect sensitive areas such as riparian areas. Protection of these areas conserve wildlife habitat and benefit wildlife within the region.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits on threatened and endangered or sensitive species in the memorial. Loss of a small portion of wildlife habitat and the potential for loss of sedentary individual animals from development of new employee housing would have long-term negligible to minor adverse effects.

Adding parking for buses and recreational vehicles would result in negligible effects on wildlife in the memorial. The long-term adverse effects on wildlife from removing the Montezuma Ranch structures would be negligible with the implementation of mitigating measures to reduce impacts on rare or uncommon species. Restoring and revegetating areas in the memorial would improve grassland habitat, benefiting wildlife species. Ending grazing in the memorial would improve habitat and forage, a long-term minor beneficial effect on wildlife.

Impairment

The wildlife resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to air quality; cave resources, soils; vegetation; threatened, endangered, or sensitive species; water quality; or wildlife would result from implementing alternative C.

ALTERNATIVE D

Air Quality

Analysis. Alternative D would affect local air quality through the fugitive dust and emissions that would result from restoration and revegetation, trail development, road and parking lot improvements, installing a new viewing structure, re the visitor center, and building a new educational facility. The effects on local air quality would be highly transient but could be noticeable to visitors and NPS staff. The adverse effects on local air quality would be negligible to minor. None of these activities would affect regional air quality.

Cumulative Effects. The actions of alternative D would not adversely affect air quality. The air quality would be more likely to be affected by the population growth in Cochise County and the pollution brought by prevailing winds. The construction activities and increased traffic that would occur under alternative D would result in local negligible to minor transient effects on air quality, and there would be no effects on regional air quality from alternative D

Conclusion. The construction and revegetation of alternative D, along with more traffic generated by increased visitation, would cause short-term negligible to minor adverse effects on local air quality at Coronado National Memorial, but the actions of alternative D would not affect regional air quality.

Cave Resources

Analysis. There are a number of caves in the national memorial, with Coronado Cave being the most prominent and accessible (0.75 mile from the visitor center). This has resulted in a visitation, by permit, of between 5% and 6% of the people that currently come to the memorial. The cave contains various limestone formations (stalactites, stalagmites, flowstone, and helicites) and provides habitat for animals. Occasionally visitors might cause slight damage to cave resources. In any one year, the damage results in negligible to minor adverse effects on cave resources. Developing a carrying capacity for Coronado Cave would result in the establishment of a monitoring system that would measure any loss of cave resources so that corrective measures could be taken. However, the loss of resources year after year could eventually result in minor long-term adverse effects on cave resources.

Cumulative Effects. The opening of Kartchner Caverns State Park about 35 miles north of the memorial has increased the interest of the visitors in caves. This interest added to the accessibility of Coronado Cave has resulted in a slight increase in visitation to the memorial's cave. This increased interest in caves has resulted in a slight loss of sensitive cave resources in the area of Cochise County.

Conclusion. There would be beneficial effects on Coronado Cave. The intensity of these effects would be difficult to quantify before the carrying capacity is determined, but the effects would be long term and probably would be negligible to minor.

Soils

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect soil resources. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on soil resources such as the creation of social trails or paths. Overall, a long-term negligible beneficial effect on soils could result from these programs.

Expanding the visitor center and adding picnic sites would result in adverse impacts on soils, but the impacts would be negligible to minor because about 70% of the development

would be in previously disturbed areas, the size of the area affected would be limited, and the erosion potential of the soils that would be affected is low.

Mitigating measures would limit erosion and confine construction activities to the immediate area. Therefore, the impacts would be negligible to minor.

Widening and paving East Forest Lane to accommodate recreational vehicles and other large vehicles, paving parking areas, and paving the road to Montezuma Ranch would compact the soils and reduce soil permeability. This would lead to more surface runoff, making slopes more vulnerable to erosion, which would increase the amount of soil eroded along the dry stream channel. This would cause higher rates of stream sedimentation in the short term. Mitigating measures would minimize erosion and limit construction activity to the immediate area.

The soils associated with the East Forest Lane road have a low erosion potential except where the road traverses the drainage, where wind erosion potentials are high (map unit 17, table 10, p. 90). The total area that would be affected by paving the road is less than 20 acres. Therefore, the local short-term and long-term adverse effects on soils would be negligible to minor, and the effects would diminish over time as the area revegetates.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of soils from erosion and compaction. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on soils would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Development and use of four new trails in previously grazed areas in the memorial's grasslands would erode and compact soils as described for alternative B. Placing three of the four trails on existing social paths or in an existing footprint such as Windmill Road would limit the disturbance of soils because these areas have been disturbed previously either by grazing or by foot traffic. Short-term and long-term adverse impacts would result from new trail construction in the grassland habitat. Because of the small area affected in relation to the size of the national memorial, the low erosion potentials of the soils, and the use of best management practices, the impacts would negligible to minor.

Adapting the Montezuma Ranch structures for use as an educational center would result in negligible adverse impacts on soils because the area has been previously disturbed, and existing roads and walkways could be used to park construction vehicles and staging equipment.

Removing the existing ranch structures and building new structures would result in more impacts than adapting the existing buildings for this use because more ground disturbance would be necessary. Soils would be compacted and erosion increased during the construction of the educational center, but because the site has been previously disturbed and the susceptibility of the soils to erosion is low, the short-term and long-term adverse impacts on soils would be negligible to minor.

Eliminating grazing from the Montezuma allotment and continuing it on the Joe's Spring allotment (1,143 acres, or 25% of the national memorial) under alternative D would affect soils in ways similar to those described for alternative A. Allowing grazing on only one allotment would reduce the area of the national memorial grazed compared to the no-action alternative.

The ongoing implementation of the *Livestock Management Plan* (NPS 2000b) is improving conditions in both grazing allotments com-

pared to pre-plan conditions. Alternative D, which would eliminate grazing in the Montezuma allotment, would further improve soil conditions in this area. This would be a long-term minor beneficial effect compared to the no-action alternative. However, the adverse effects of grazing on soils in the Joe's Spring allotment would continue under alternative D.

Cumulative Effects. Similar to alternative A, because the national memorial is on a smuggling route for undocumented people and illegal drugs, such use has resulted in the creation of many footpaths, especially along drainages. The construction of a fence by the U.S. Border Patrol at the United States–Mexican border might funnel foot traffic westward into the memorial, which would create more footpaths, degrading soils and vegetation. In addition, soils in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Soil compaction and erosion would occur along existing trails and by the creation of social trails. Similar effects result from the development of game trails by wildlife in the area. These activities, along with the activities associated with the no-action alternative, would result in minor adverse impacts on soils throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Expanding the visitor center and adding picnic sites with low erosion potential would result in negligible to minor adverse effects on soils because these actions would take place in small previously disturbed areas. Mitigative measures would minimize erosion and limit construction to the immediate area.

The short-term and long-term adverse effects on soils from paving roads, developing parking areas and trails, and developing an educational center at Montezuma Ranch would be negligible to minor because the area affected would be small, and best management practices would be used to reduce soil impacts.

The development of new employee housing would result in long-term negligible to minor adverse effects on soils, and mitigation measures would be employed to reduce erosion. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to soils in the memorial.

Continuing grazing in the Joe's Spring allotment would result in minor long-term adverse impacts on soils, but they would be offset by eliminating grazing from the Montezuma allotment.

Vegetation

Analysis. Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect vegetation. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on vegetative communities such as the creation of social trails. Overall, a long-term negligible beneficial effect on vegetation could result from these programs.

Expanding the visitor center and adding picnic sites would adversely affect vegetation, but the effects would be negligible to minor because about 70% of the development would be in previously disturbed areas and the size of the affected area would be limited. There would be fewer impacts on vegetation than would be caused by construction in

undisturbed sites. Plant communities that have been fragmented and disturbed have a greater potential for the presence of nonnative species, reducing the ecological health and integrity of the area. Mitigating measures would limit erosion and limit construction activities to the immediate area, so the impacts would be negligible to minor.

Widening and paving East Forest Lane, which parallels and traverses a drainage, would result in the removal of riparian vegetation in the western honey mesquite–mixed short tree woodland association, further increasing erosion into the stream channel, which would contribute to higher rates of stream sedimentation. The local long-term adverse impacts on riparian vegetation would be minor because only a small area would be affected and mitigating measures would be implemented to reduce erosion and reestablish vegetation. Vegetation along the road and in the parking areas would be adversely affected. Only the vegetation in the area adjacent to the development would be affected, and mitigating measures would minimize erosion and limit construction activity to the immediate area.

The loss of individual plants from trampling and uprooting and the potential for more nonnative plants to invade disturbed areas would be a short-term adverse effect. The total area that would be paved is less than 20 acres; therefore, the local short-term and long-term adverse effects on vegetation would be negligible to minor. The adverse effects would diminish over time as the area revegetated.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of vegetation from erosion and compaction as well as from the uprooting and loss of individual plants. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on vegetation would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Developing four new trails in previously grazed areas in the grasslands would result in the same effects on vegetation as those described for alternative B. Placing three of the four trails on existing social paths or in an existing footprint such as Windmill Road would limit the disturbance of soils and vegetation because these areas have been disturbed previously either by grazing or foot traffic. Short-term and long-term adverse impacts would result from new trail construction in the grassland habitat. Because of the small area affected in relation to the size of the national memorial, the low erosion potentials of the soils, and the use of best management practices, the impacts would negligible to minor.

Removing the Montezuma Ranch structures and replacing them with new buildings or adapting them for use as an educational center would result in the disturbance, trampling, and uprooting of grassland vegetation from the use and staging of construction equipment. Mitigating measures would reduce erosion and limit equipment to the immediate vicinity, so that the local adverse impacts on vegetation would be negligible to minor. Adapting the existing structures for use as the educational center would cause fewer impacts on vegetation in the immediate area than would building new structures because there would be less construction. The local adverse effects would be negligible, and the overall effects on vegetation throughout the memorial from either scenario would be negligible because only a small area would be affected.

Eliminating grazing from the Montezuma allotment and continuing it in the Joe's Spring allotment would cause impacts on vegetation similar to those described for alternative A. The vegetative communities affected would be those that are predominantly oak-Mexican piñon-juniper and grama species mixed

grass-mixed shrub associations, which constitute 93% of the memorial's total vegetation. However, allowing grazing on only one allotment would reduce by 14% the area of the national memorial grazed compared to the no-action alternative. The long-term adverse impacts on vegetation from grazing would be minor. As under the no-action alternative, the effects would be partially mitigated by reducing grazing intensity and shortening the season of use, and livestock use of riparian areas would be mitigated by controlling water sources, using salt blocks, and following an adaptive management approach. The effects of continued grazing on range condition would be similar to those of alternative A, but slightly fewer.

Cumulative Effects. Similar to alternative A, the footpaths along drainages resulting from the smuggling route for undocumented people and illegal drugs, along with the creation of more footpaths resulting from the construction of a fence by the U.S. Border Patrol, could degrade vegetation. This, along with the actions of the no-action alternative, would result in minor adverse impacts on vegetation throughout the memorial.

In June 1988 Coronado National Memorial was affected by the Peak Fire. In the memorial, the oak-Mexican piñon pine-juniper woodland association was most affected by the fast-moving, intense fire in continuous grass fuels because about 2,600 acres of the 3,700 acres that burned were in this habitat. Most of this biotic community was burned moderately, but some areas in the western part of the memorial were severely burned. However, by August 1989 many trees had resprouted either from the roots or from undamaged areas of the trunk.

The species composition of the woodland understory was significantly changed after the fire, probably because of the influx of nutrients or appropriate conditions for the germination of numerous herbaceous species that were either rare or absent before the fire. The grama grass-mixed grass-mixed shrub association was relatively unaffected by the fire because little fuel was present to sustain a high temperature. Consequently, the effect of the fire on this habitat was largely ephemeral because most of these species are fire-adapted and quickly resprout from roots. Under alternative D, vegetation would be disturbed, which would affect mainly grassland habitats; therefore, these disturbances would contribute little cumulatively to the past impacts of the 1988 wildfire.

Regionally, wildland fire is an increasing threat in scale and severity. Developing a fire management plan would reduce hazardous fuels in the memorial, diminishing the potential for wildland fire in the memorial and beyond its boundaries. A future fire management plan, in combination with similar plans for Coronado National Forest and Fort Huachuca, would result in long-term minor benefits for vegetation in the region.

The encroachment of woody species into grasslands in the upper San Pedro Basin is a factor in regional decreases in the amount and ecological functioning of native grasslands and in their fragmentation into small, disconnected patches. Regional urban development also results in a loss of grassland acreage. Continuing grazing in the memorial would increase native shrubs, contributing to these cumulative adverse regional effects. Experimental investigation and treatments of Lehmann lovegrass are being conducted on Fort Huachuca. The no-action alternative would not contribute cumulatively to regional impacts on grasslands.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Expanding the visitor center and adding picnic sites with low erosion potential would result in negligible to minor adverse effects on vegetation because these actions would take place in previously disturbed areas and the areas would be small. Mitigative measures would minimize erosion and limit construction activities to the immediate area.

The development of new employee housing would result in long-term negligible to minor adverse effects on vegetation, and mitigation measures would be employed. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to vegetation in the memorial.

Individual plants would be trampled and uprooted during the paving of roads and parking areas and the development of trails. The short-term and long-term adverse impacts on vegetation from paving roads, developing parking areas and trails, and developing an educational center would be negligible to minor because the area affected would be small and best management practices would be used to reduce impacts. Only the vegetation in the area adjacent to the development would be affected. The adverse effects would diminish over time as the area revegetated.

Grazing in the Joe's Spring allotment would continue to adversely affect vegetation in the memorial, but the minor long-term adverse effects would be offset by the beneficial effects from ending grazing in the Montezuma allotment.

Threatened, Endangered, or Sensitive Species

Analysis. The knowledge gained through establishing an inventory program would enable NPS personnel to better protect sensitive resources such as threatened and endangered species. Educating the public through new interpretive materials could help to reduce the adverse impacts on resources that sensitive species rely on. Overall, developing interpretive programs would result in a beneficial effect on threatened, endangered, or sensitive species.

Placing about 70% of the development (visitor center expansion, added trails, parking lots, pullouts) in previously disturbed areas would not directly affect any listed or sensitive species. The development would disturb the food sources of the lesser long-nosed bat, the Mexican long-tongue bat and the loggerhead shrike, resulting in indirect negligible effects. Individuals of small mammal or reptile species that are prey for loggerhead shrikes might be displaced by development activities, an adverse effect, but there would not be any measurable effect on population densities.

Vegetative resources would be most affected by widening and paving East Forest Lane road. The adverse effects of road construction on vegetation would be minor to moderate in the road area but negligible as related to the overall national memorial. With mitigation to transplant agaves in construction sites to prevent the loss of important food sources for nectar-feeding bats, the development activities of alternative D would not alter the population of agave plants.

Development activities might affect the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike but would not be likely to adversely affect these species. Because the area where the development would occur is not in prime foraging or nesting habitat for the Mexican spotted owl, these activities would not be likely to adversely affect this species.

Adapting the Montezuma Ranch structures for use as an educational center or removing them and building new buildings would result in negligible to minor adverse effects on listed or sensitive species similar to the effects of removing the ranch structures described for alternative A. Adapting the existing structures for use as the educational center would result

in fewer impacts on sensitive species in the immediate area than would building new buildings. The indirect effects on the long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike would be negligible, and the activities would not be likely to adversely affect these species.

The adverse impacts of grazing on vegetation and wildlife would continue in the Joe's Spring allotment under alternative D, causing indirect effects on the loggerhead shrike similar to those described for alternative A. Alternative D would have a negligible effect on nectar-feeding bats and would not be likely to adversely affect the lesser long-nosed bats.

Because suitable nesting and foraging habitat for the Mexican spotted owl is lacking in the Joe's Spring allotment, it is unlikely that the owls use that allotment. Continued grazing in the Joe's Spring allotment under alternative D might affect, but would not be likely to adversely affect, the Mexican spotted owl.

Cumulative Effects. Similar to alternative B, efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Natural areas adjacent to the memorial such as the national forests, the national conservation area, and state parks offer interpretive programs and provide visitor information related to the unique natural environment found in the region. These programs along with enhanced interpretation and inventorying of memorial resources that enhance public awareness and understanding of the natural environment would benefit all natural resources.

A loss of trees in the memorial and the resultant growth of high elevation grasses since the wildfires of 1988 have resulted in an increase in rodent species, which has increased the availability of prey for the loggerhead shrike, a minor beneficial effect for the shrikes and their prey. Eliminating a portion of the grazing under alternative D would increase grassland habitat and small mammal habitat, which would increase the prey abundance for the shrike. Ending some grazing in the memorial, combined with the effects of the past fire, would result in a minor cumulative benefit to the loggerhead shrike.

As has been mentioned, wildfire is the primary threat to the persistence and recovery of the Mexican spotted owl (USFWS 1995b). The loss of owl habitat in the memorial from the 1988 wildfire, together with the potential for future catastrophic fire, represents a moderate to major threat to this species. Limiting the removal of powerlines in the proposed protected activity center to a time not in the owl's breeding season would cause negligible effects on the species. This activity, combined with habitat loss from wildfire, would cause moderate to major effects on the Mexican spotted owl. Actions to reduce hazardous fuel loads in Coronado National Forest, which would be identified in a future fire management plan and are currently underway on Fort Huachuca, would cumulatively benefit the owls by reducing the likelihood of habitat alteration.

The restoration of grassland on Fort Huachuca is improving the ecological integrity and function of native grasslands. Prescribed burns on private and public lands are being used to maintain grasslands, which might increase the region's agave population, a minor to moderate benefit for nectar-feeding bats in the region. Alternative D would make a negligible contribution to these beneficial effects on grasslands and nectar-feeding bats. The overall beneficial cumulative effect on listed and sensitive bat species in the region would range up to moderate.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits to threatened and endangered or sensitive species in the memorial.

The development-related activities of alternative D north of the main memorial road would not alter the population of agave plants, which are the food source of the lesser long-nosed and Mexican long-tongued bats. However, individual plants might be disturbed by building trails in grasslands or by paving roads and parking areas. These activities would not alter the populations of small mammals and reptiles that are the prey base of the loggerhead shrike There might be indirect negligible effects, but it is not likely that there would be adverse effects on these species.

The developments north of the main memorial road would not be in prime Mexican spotted owl foraging or nesting habitat, and the availability of the owl's prey species in this area is low. Therefore, the developments of alternative D would not be likely to adversely affect the Mexican spotted owl.

Adapting the Montezuma Ranch structures for use as an educational center or removing them and building new buildings would disturb agave plants and small mammals that are food sources for loggerhead shrikes, lesser long-nosed bats, and Mexican long-tongued bats, resulting in negligible to minor indirect effects on these species. Adapting the structures would not be likely to adversely affect these species.

Restoring and revegetating the ranch area after the area is developed as an educational center would result in about the same number of agave plants as currently. Revegetation of the area probably would maintain the habitat and prey species of the loggerhead shrikes. Thus there would be long-term negligible effects on these species.

It is unlikely that Mexican spotted owls use the grazing allotments. Therefore, gazing associated with this alternative would not be likely to adversely affect this species.

Grazing associated with alternative D would have a negligible effect on nectar-feeding bats and would not be likely to adversely affect the lesser long-nosed bat.

Continued grazing on the Joe's Spring allotment would disturb the food sources of the loggerhead shrike, indirectly affecting this species.

Water Quality

Analysis. Better protection of soils and vegetation through a monitoring program would lead to better protection of water quality, an overall beneficial effect on water quality under this alternative. Developing new employee housing would not affect riparian habitat, and mitigative measures would include actions to minimize erosion by stabilization with structures or vegetation. Therefore, there would be no adverse impact on water quality from building new housing.

Expanding the visitor center and pullouts and adding more picnic sites under alternative D would affect water quality in ways similar to those described for alternative B. The adverse effects would be negligible to minor because most of the development would be in previously disturbed areas, the developments would be located away from stream channels, and mitigative measures would limit construction activities to the immediate area and minimize erosion and sedimentation.

Widening and paving East Forest Lane, which parallels and traverses a drainage, would compact the soils, reducing soil permeability. This would lead to more surface runoff, which would make slopes more vulnerable to erosion, increasing sedimentation during construction. The widening and paving also would result in the removal of riparian vegetation in the western honey mesquite-mixed short tree woodland association, further increasing erosion into the stream channel, which would contribute to higher rates of stream sedimentation. The short-term adverse impacts on water quality would be minor because the area affected would be

small, and the effects would lessen over time with the reestablishment of vegetation, so that the long-term effects would be negligible.

Developing three new trails, if they were designed to cross drainages, would affect a small part of the riparian habitat, causing the loss of riparian vegetation and soils, consequently affecting water quality. The short-term adverse effects on water quality from new trail development would be minor with the implementation of mitigating measures to reduce the disturbance of streambanks and vegetation, and the long-term effects would be reduced by the reestablishment of riparian vegetation, which would reduce streambank erosion and sedimentation.

Removing the Montezuma Ranch structures and building an educational center or converting the existing buildings to an educational center would not take place near drainages or riparian habitats, and best management practices would be used to reduce soil erosion. Therefore, the effects on water quality would be negligible.

Ending grazing in the Montezuma allotment and continuing it in the Joe's Spring allotment would result in adverse effects on water quality similar to those described for alternative A; however, there would be offsetting beneficial effects from ending grazing in the Montezuma allotment. As in the no-action alternative, the impacts would be partially mitigated by the actions of the *Livestock Management Plan:* resting pastures every three years, controlling water sources, using salt blocks, and using an adaptive management approach. The long-term adverse effects on water quality from grazing would be minor.

Cumulative Effects. As in alternative A, recreation, cattle grazing, ranching, road construction, water diversion, and urban development in the region all cumulatively affect soils, vegetation, and riparian environments, and consequently water quality.

Livestock grazing in riparian areas in upland communities would continue to affect water quality downstream on a reduced basis by reducing water infiltration and increasing runoff, erosion, sedimentation, and turbidity. The compaction of soils in grazed areas would continue to lead to reduced water infiltration and increased runoff, erosion, and sediment delivery to streams.

Continued grazing in the national memorial, even though grazing would be eliminated from one allotment, would contribute cumulatively to adverse effects on water quality. However, with the *Livestock Management Plan* in use, the effects of grazing in the memorial would be minimal in relation to other development and agricultural activities in the area. The effects on soils, vegetation, and riparian habitat in the memorial resulting from the actions of alternative D would add little to the regional cumulative effects on water quality compared to the disturbance occurring in other parts of the region.

Both allotments in the national memorial drain into the San Pedro River in either the United States or Mexico. The Arizona Department of Environmental Quality monitors water quality in the San Pedro River at a station approximately 9 miles east of the memorial and less than 4 miles north of the international boundary. The Environmental Protection Agency has classified portions of the San Pedro River between the Mexico border and Charleston Arizona as impaired under section 303d of the Clean Water Act because of turbidity levels that exceed water quality standards (AZ Dept. of Env. Qual. 1998). Over five years, 10%–25% of the samples taken exceeded the turbidity standard for the designated uses of aquatic life, wildlife, full body contact, and agriculture irrigation/ livestock water. However, the sources have been attributed to natural processes and grazing outside Arizona's jurisdiction.

The paths that have been created near the smuggling route for undocumented aliens and

illegal drugs would continue to adversely affect riparian habitats through trampling of vegetation and increased erosion. This, coupled with the adverse impacts from grazing, would continue under alternative A, cumulatively affecting riparian habitat and consequently water quality.

Developing additional employee housing in the memorial would not contribute to the cumulative effects of these other activities occurring in the region.

Conclusion. No adverse effects on water quality would be anticipated from developing additional employee housing. The establishment of monitoring programs in the memorial to monitor activities such as grazing would benefit overall water quality in the memorial.

Expanding the visitor center and adding picnic sites in previously disturbed areas would result in negligible to minor effects on water quality because the development would not take place in riparian habitat or near drainages. Mitigating measures would minimize erosion and limit construction to the immediate area.

Removing the Montezuma Ranch structures and replacing them with new buildings or adapting them for use as an educational center would not affect water quality.

Paving East Forest Lane and developing trails would result in short-term minor adverse impacts on water quality because construction would increase soil erosion and sedimentation. The long-term impacts would be negligible because riparian vegetation would recover along the streambank.

Continuing grazing in the Joe's Spring allotment would continue to affect water quality adversely through continued streambank erosion and sedimentation, but ending grazing in the Montezuma allotment would offset these effects.

Wildlife

Analysis. Through knowledge gained from an inventory and monitoring program, national memorial staff could better protect wildlife habitat. Educating the public with interpretive materials could reduce impacts on wildlife and habitat from visitor use. Overall, developing interpretive programs would result in a beneficial effect on wildlife.

New employee housing would affect wildlife in that mobile animals would move during development to similar adjacent habitats, and slow or sedentary animals such as some reptiles, amphibians, and small mammals might be lost. For animal species that are common in the memorial, the construction would have negligible adverse effects. The rare or uncommon species that are slow or sedentary, particularly amphibians and reptiles, would be more susceptible to adverse effects from construction. However, with mitigating measures to reduce the potential loss of individuals of rare or uncommon species, the long-term adverse effects on wildlife would be negligible to minor.

Expanding the visitor center and adding picnic sites in previously disturbed areas would result in effects on wildlife similar to those described for alternative B.

Paving parking areas and building a paved road to Montezuma Ranch would result in the loss of wildlife habitat and individuals, but the areas affected would be small; therefore, the adverse effects would be negligible.

Rebuilding and paving East Forest Lane could result in increased human presence, possibly preventing migrating species, particularly predators, from using the area. The drainage that the road crosses represents the best potential conduit for wildlife from the Huachuca Mountains. Roads can significantly affect wildlife demographics and movements, can cause loss of habitat, and can have detrimental effects on large animals through road kill and avoidance behaviors that fragment

populations (Trombulak and Frissel 2000). Indirect effects can include more human access into areas, which further exacerbates the effect of the roads (Hass 2000). Therefore, paving this road, which would bring more visitors into the area, would result in long-term minor adverse effects on wildlife populations.

Developing four new trails in the grassland would result in impacts similar to those described for alternative B. Wildlife would be disturbed, but the long-term adverse effects would be negligible to minor because only a small portion of available wildlife habitat in the memorial would be disturbed.

Some benefits to individual animals in the memorial might result from trail and road development. Animals such as mule deer and white-tailed deer might use the trails and roads to facilitate movement within the habitat. Ease of movement might benefit individuals of those species by reducing energy expenditures. The long-term benefits would likely be negligible.

Removing the existing Montezuma Ranch structures and building an educational center would adversely affect wildlife in ways similar to the effects of removing the ranch structures described for alternative A. Adapting the existing structures for use as the educational center would result in fewer impacts on wildlife in the immediate area than would the construction of a new center. The local adverse effects on wildlife would be negligible.

Continuing grazing in the Joe's Spring allotment and ending grazing in the Montezuma allotment would reduce the area grazed by 14%, increasing grassland habitat and forage. This would benefit wildlife, particularly small mammals and their predators. The reduced impacts on riparian vegetation would increase cover and nesting habitat, benefiting such species as migrating birds, deer, and predators because the drainages in the allotment are used as wildlife corridors. The long-term beneficial effects on the national memorial's wildlife would be minor.

Cumulative Effects. Developments by the border patrol to improve roads and install fencing and lighting adversely affect wildlife by impeding movement, altering feeding patterns, and reducing habitat quality for nesting and feeding. Development, grazing, and loss of habitat in areas adjacent to the national memorial and in the San Pedro River valley might result in the loss of more wildlife species from the memorial. Timber harvesting and hunting in the adjacent Coronado National Forest would reduce available wildlife habitat, alter animal behaviors, and results in the removal of individuals. Although thought to be rare in the memorial, poaching of reptiles and amphibians results in a loss of individuals and may reduce populations of rare or uncommon species in the region. Development within the national memorial including new employee housing which would result in the loss of a small portion of wildlife habitat would contribute negligibly to the adverse cumulative effects of these other regional activities.

As described in alternative B, grassland restoration in Fort Huachuca is being used to improve the ecological integrity and function of native grasslands, and prescribed burning on private and public lands in the area is used to maintain grasslands. The actions of alternative D would contribute cumulatively to these regional beneficial effects on grasslands except that one grazing allotment would remain active.

As described in alternative B, in combination with forest conservation actions in the isolated mountains of southeastern Arizona and in the San Pedro River National Conservation Area, the actions of alternative D would benefit both migratory birds and larger, dispersing animals that require more forest habitat to sustain viable populations. The Upper San Pedro Valley is a major neotropical migrant bird corridor. Woodlands and forest habitats in the Huachuca

Mountains and in the San Pedro River National Conservation Area are important habitat resources for migrating birds.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits on threatened and endangered or sensitive species in the memorial. Loss of a small portion of wildlife habitat and the potential for loss of sedentary individual animals from development of new employee housing would have long-term negligible to minor adverse effects.

The adverse effects on wildlife from expanding the visitor center and adding picnic sites in previously disturbed areas would be negligible to minor. Removing the Montezuma Ranch structures and using mitigative measures to reduce impacts on rare or uncommon species would result in long-term negligible adverse effects on wildlife. Developing trails in the memorial would result in short-term adverse effects on wildlife, but the effects would be negligible to minor because the areas affected would be small. Trails and roads might benefit some species by facilitating movement.

Widening and paving East Forest Lane road, with the resultant increased visitor access, would cause long-term minor adverse local effects on wildlife from increased potential for roadkill and the continued fragmentation of habitat. These actions also would degrade the value of the drainages as migration corridors. Ending grazing in the Montezuma allotment would increase grassland forage and improve riparian habitat, resulting in long-term minor beneficial effects for wildlife.

Impairment

The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, alternative D would not result in any impairment of resources or values related to air quality; cave resources, soils; vegetation; threatened, endangered, or sensitive species; water quality; or wildlife.

ALTERNATIVE E

Air Quality

Analysis. Dust and construction equipment emissions would be produced under alternative E from revegetation, trail improvements, and the construction of a new visitor center. The effects from these actions on local air quality would be transient, short-term and local, but they could be noticeable to visitors and NPS staff. The short-term adverse effects on local air quality would be negligible to minor. None of these activities would affect regional air quality.

Traffic emissions from vehicles would increase with growing visitation, but the memorial would continue to meet all applicable air quality criteria. The changes in emissions would result in negligible short-term adverse effects. Other plans and management activities of the national memorial would not adversely affect air quality.

Cumulative Effects. Population growth and development outside the national memorial would be more likely to affect air quality than the management activities of the memorial. In addition, emissions from Tucson and Mexico are carried to the memorial by prevailing winds. Alternative E, in conjunction with other actions, would contribute negligibly to short-term local adverse effects on air quality but would not affect regional air quality.

Conclusion. The construction activities and increased traffic from more visitation in alternative E would cause negligible local short-term adverse effects on local air quality at the memorial but would not affect regional air quality.

Cave Resources

Analysis. There are a number of caves in the national memorial, with Coronado Cave being the most prominent and accessible (0.75 mile from the visitor center). This has resulted in a visitation, by permit, of between 5% and 6% of the people that currently come to the memorial. The cave contains various limestone formations (stalactites, stalagmites, flowstone, and helicites) and provides habitat for animals. Occasionally visitors might cause slight damage to cave resources. In any one year, the damage results in negligible to minor adverse effects on cave resources. Developing a carrying capacity for Coronado Cave would result in the establishment of a monitoring system that would measure any loss of cave resources so that corrective measures could be taken. However, the loss of resources year after year could eventually result in minor long-term adverse effects on cave resources.

Cumulative Effects. The opening of Kartchner Caverns State Park about 35 miles north of the memorial has increased the interest of the visitors in caves. This interest added to the accessibility of Coronado Cave has resulted in a slight increase in visitation to the memorial's cave. This increased interest in caves has resulted in a slight loss of sensitive cave resources in the area of Cochise County.

Conclusion. There would be beneficial effects on Coronado Cave. The intensity of these effects would be difficult to quantify before the carrying capacity is determined, but the effects would be long term and probably would be negligible to minor.

Soils

Analysis. Building a new visitor center and a hardened parking area in the area now occupied by the Joe's Spring allotment (in the grassland area about 1 mile north of the main road) would result in soil erosion and compaction. The land where the visitor center would be developed has been grazed previously, and the grassland habitat where the facilities would be built has a low potential for soil erosion. Ground disturbance would be concentrated north of the main road. About 10% of these actions would take place in previously disturbed areas and 90% would occur in undisturbed areas.

Removing vegetation or surface layers or compacting soils to prepare for the development would result in negligible to minor short-term and long-term adverse impacts on soils, which would be lessened by the use of mitigative measures to minimize erosion and limit construction activities to the immediate area.

Widening and paving Windmill Road to accommodate large vehicles and creating a hardened parking area near the new visitor center would compact the soils and reduce soil permeability. This would result in more surface runoff, which would make adjacent slopes more vulnerable to erosion. Paving the part of Windmill Road that parallels a dry streambed might increase the amount of soil eroded along the stream channel, resulting in higher rates of stream sedimentation. The short-term and long-term adverse impacts on soils from these actions of alternative E would be negligible to minor.

In alternative E, establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect soil resources. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could

facilitate NPS efforts to reduce visitors' effects on soil resources such as the creation of social trails or paths. Overall, a long-term negligible beneficial effect on soils could result from these programs.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of soils from erosion and compaction. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on soils would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Developing three new trails in the grassland areas would disturb or remove vegetation, resulting in effects on soils similar to those described for trail development in alternative D.

Removing the Montezuma Ranch structures and restoring the area would result in beneficial effects on soils similar to those described for alternative A.

Ending grazing in the Joe's Spring allotment and continuing grazing in the Montezuma allotment (668 acres, or 14% of the national memorial) would result in impacts similar to those described for alternative A. However, allowing grazing on only one allotment would reduce by 25% the area of the national memorial grazed compared to the no-action alternative. The local long-term adverse impacts on soils from grazing would be minor, and they would be offset by the minor beneficial effects from ending grazing in the Joe's Spring allotment. As under the no-action alternative, the effects would be partially mitigated by resting the pastures once every three years, and the use of riparian areas would be mitigated by controlling water sources, using salt blocks, and following an adaptive management approach.

Cumulative Effects. Similar to alternative A, because the national memorial is on a smuggling route for undocumented people and illegal drugs, such use has resulted in the creation of many footpaths, especially along drainages. The construction of a fence by the U.S. Border Patrol at the United States–Mexican border might funnel foot traffic westward into the memorial, which would create more footpaths, degrading soils and vegetation. In addition, soils in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Soil compaction and erosion would occur along existing trails and by the creation of social trails. Similar effects result from the development of game trails by wildlife in the area. These activities, along with the activities associated with the no-action alternative, would result in minor adverse impacts on soils throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Developing a new visitor center under alternative E would result in ground disturbance, which would cause local short-term and long-term adverse effects on soils. These effects would be negligible to minor because the area affected would be small and mitigating measures would be used. Paving roads, adding parking areas, and developing trails would result in short-term and long-term negligible to minor adverse effects on soils. Those short-term effects would diminish over time with the recovery of vegetation along the road.

Removing the Montezuma Ranch structures would result in short-term negligible to minor adverse impacts on soils, which would be offset by long-term beneficial effects from

restoring and revegetating the site, which would improve soils by reducing compaction and increasing permeability. This would result in local long-term negligible to minor beneficial effects.

The development of new employee housing would result in long-term negligible to minor adverse effects on soils, and mitigation measures would be employed to reduce erosion. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to soils in the memorial.

Continuing grazing in the Montezuma allotment (14% of the national memorial) would result in minor long-term adverse impacts on soils, but they would be offset by eliminating grazing from the Joe's Spring allotment.

Vegetation

Analysis. Building a new visitor center and a hardened parking area in the area now occupied by the Joe's Spring allotment would result in soil erosion and compaction on previously grazed land. The soil erosion potential is low in the grassland where the facilities would be built. The ground disturbance would be concentrated north of the main road. About 10% of these actions would take place in previously disturbed areas and 90% would occur in undisturbed areas.

Removing vegetation or surface layers or compacting soils to prepare for the development would adversely affect vegetation, which would be lessened by the use of mitigative measures to minimize erosion and limit construction activities to the immediate area. Those adverse impacts on vegetation would be negligible to minor with the use of mitigating measures.

Widening and paving Windmill Road to accommodate large vehicles and creating a hardened parking area near the new visitor center would result in the trampling and uprooting of plants and compact the soils, reducing soil permeability. Paving the part of Windmill Road that parallels a dry streambed might increase the amount of soil eroded along the stream channel, resulting in higher rates of stream sedimentation.

The local short-term adverse effects on vegetation (similar to those described for alternative D) would be negligible to minor because the area affected would be small and best management practices would be followed to reduce their intensity. The effects would diminish over time as vegetation along the road recovered.

Establishing a program to inventory, document, and interpret natural resources in the memorial would improve the memorial staff's ability to protect vegetation. Developing more interpretive materials and programs would help the public understand the memorial's resources of the memorial and the impacts associated with human activity. This understanding could facilitate NPS efforts to reduce visitors' effects on vegetative communities such as the creation of social trails. Overall, a long-term negligible beneficial effect on vegetation could result from these programs.

Adding new employee housing in the current residential area north of the visitor center could lead to a loss of vegetation from erosion and compaction as well as from the uprooting and loss of individual plants. However, the area affected would be small (less than 1 acre). Soils that have been excavated and/or covered by impervious surfaces such as roads, parking lots, or buildings may lack typical physical, biological, and chemical properties. Therefore, the long-term adverse impacts of this development on vegetation would be negligible to minor, and mitigative measures would be used to minimize erosion and to limit construction activities to the immediate area.

Developing three new trails in the grassland areas would disturb or remove vegetation, re-

sulting in effects on soils and vegetation similar to those described for trail development in alternative D.

Removing the Montezuma Ranch structures and restoring the area would result in beneficial effects on vegetation similar to those described for alternative A.

Eliminating grazing from the Joe's Spring allotment and continuing grazing in the Montezuma allotment (668 acres, or 14% of the national memorial) would result in impacts similar to those described for alternative A, but the area grazed would be reduced by 25% compared to alternative A. The local long-term adverse impacts on vegetation in the memorial from grazing would be minor, and they would be offset by the minor beneficial effects of ending grazing in the Joe's Spring allotment. As under the no-action alternative, the effects would be partly mitigated by resting the pastures once every three years, and the use of riparian areas would be mitigated by controlling water sources, using salt blocks, and following an adaptive management approach. The effects on range condition would be similar to those described for alternative D, but the area affected would be slightly (11%) smaller.

Cumulative Effects. The encroachment of woody species throughout grasslands in the upper San Pedro Basin is a factor in regional decreases in the amount and ecological functioning of native grasslands and in their fragmentation into small, disconnected patches. Urban development in the region also has resulted in a loss of grassland acreage. Another regional issue is the intrusion of nonnative plant species. Fort Huachuca and Coronado National Forest are trying to prevent the introduction of such species and control their spread. Fort Huachuca is conducting experimental investigation and treatments of Lehmann lovegrass. Ending grazing in the national memorial would benefit the grassland habitat, and restoring native species under alternative B would benefit vegetation. However, the actions of alternative B would not offset the loss of grasslands from development or the invasion of nonnative plants in the region, and implementing the alternative would contribute little cumulatively to regional effects.

Coronado National Memorial is on a smuggling route for undocumented people and illegal drugs. The illegal entry across the United States border into the memorial has resulted in soil compaction and erosion resulting from the development of numerous footpaths. In addition, vegetation in the memorial would be affected to a negligible degree by visitor use of trails and picnic areas. Visitor use results in soil compaction and erosion along existing trails and the creation of social trails, which results in uprooting and damage to vegetation in the local area. These activities, along with the development of additional employee housing, would result in negligible to minor adverse impacts on soils throughout the national memorial.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial would enhance public awareness of the natural environment, which would benefit all natural resources.

Conclusion. Developing a new visitor center would cause ground disturbance, which would lead to local short-term and long-term adverse effects on vegetation. These effects would be negligible to minor because the area affected would be small and mitigating measures would be used. Paving roads, adding parking areas, and developing trails would result in short-term and long-term negligible to minor adverse impacts on grassland vegetation. Those short-term effects would diminish over time as vegetation along the road recovered.

The development of new employee housing would result in long-term negligible to minor

adverse effects on vegetation, and mitigation measures would be employed. Programs to interpret, document, and inventory memorial resources and uses would result in long-term negligible benefits to vegetation in the memorial.

Removing the Montezuma Ranch structures would result in short-term negligible to minor adverse impacts on vegetation. This would be offset by long-term beneficial effects from restoring and revegetating the site, which would reduce compaction and increase permeability, resulting in local long-term negligible to minor beneficial effects.

Continuing grazing in the Montezuma allotment (14% of the memorial) would result in minor long-term adverse impacts on vegetation, but they would be offset by eliminating grazing from the Joe's Spring allotment.

Threatened, Endangered, or Sensitive Species

Analysis. The knowledge gained through establishing an inventory program would enable NPS personnel to better protect sensitive resources such as threatened and endangered species. Educating the public through new interpretive materials could help to reduce the adverse impacts on resources that sensitive species rely on. Overall, developing interpretive programs would result in a beneficial effect on threatened, endangered, or sensitive species.

About 90% of the development in alternative E — a new visitor center, parking areas, trails, and paving Windmill road — would be carried out in previously undisturbed areas and 10% in previously disturbed areas. These activities would result in indirect effects on lesser long-nosed and Mexican long-tongued bats and loggerhead shrikes by disturbing their prey base. Development also would cause the loss of habitat and food for small mammal species that serve as prey for the loggerhead shrike and might displace individuals of these prey species, but it is not likely that there would be a change in the overall availability of prey for the shrike.

With mitigation to transplant agaves in construction sites to prevent the loss of important food sources for nectar-feeding bats, the development activities of alternative E would not alter the population of agave plants, and the effects on the memorial's overall agave population would be negligible to minor. Development would affect an area smaller than 5 acres (less than 1% of the memorial's total acreage); therefore, alternative E might indirectly affect the lesser long-nosed and Mexican long-tongued bats and the loggerhead shrike but would not be likely to adversely affect these species. Because the area where the development would occur is not in prime owl foraging or nesting habitat, these activities would not be likely to adversely affect the Mexican spotted owl.

Removing the Montezuma Ranch structures, restoring the area's natural contours, and revegetating it would result in effects on sensitive species similar to those described for alternative A.

Ending grazing in the Joe's Spring allotment and continuing grazing in the Montezuma allotment (a 25% reduction in area compared to the no-action alternative) would continue to affect vegetation that serves as habitat and cover for loggerhead shrikes. It would have a negligible effect on nectar-feeding bats. Continued grazing on the Montezuma allotment would not be likely to adversely affect the lesser long-nosed bat.

Because suitable nesting and foraging habitat for the Mexican spotted owl is lacking in the Montezuma allotment, it is unlikely that the owls use that allotment. Continued grazing on the Montezuma allotment under alternative E might affect, but would not be likely to adversely affect, the Mexican spotted owl.

Cumulative Effects. Efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities' efforts to conserve and enhance the protection of natural resources in the area. Natural areas adjacent to the memorial such as the national forests, the national conservation area, and state parks offer interpretive programs and provide visitor information related to the unique natural environment found in the region. These programs along with enhanced interpretation and inventorying of memorial resources that enhance public awareness and understanding of the natural environment would benefit all natural resources.

A loss of trees in the memorial and the resultant growth of high elevation grasses since the wildfires of 1988 have resulted in an increase in rodent species, which has increased the availability of prey for the loggerhead shrike, a minor beneficial effect for the shrikes and their prey. Eliminating some grazing under alternative E would increase grassland habitat and small mammal habitat, which would increase the prey abundance for the shrike. Ending some grazing in the memorial, combined with the effects of the past fire, would result in a minor cumulative benefit to the loggerhead shrike.

As has been mentioned, wildfire is the primary threat to the persistence and recovery of the Mexican spotted owl (USFWS 1995b). The loss of owl habitat in the memorial from the 1988 wildfire, together with the potential for future catastrophic fire, represents a moderate to major threat to this species. Limiting the removal of powerlines in the proposed protected activity center to a time not in the owl's breeding season would cause negligible effects on the species. This activity, combined with habitat loss from wildfire, would cause moderate to major effects on the Mexican spotted owl. Actions to reduce hazardous fuel loads in Coronado National Forest, which would be identified in a future fire management plan and are currently underway on Fort Huachuca, would cumulatively benefit the owls by reducing the likelihood of habitat alteration.

The restoration of grassland on Fort Huachuca is improving the ecological integrity and function of native grasslands. Prescribed burns on private and public lands are being used to maintain grasslands, which might increase the region's agave population, a minor to moderate benefit for nectar-feeding bats in the region. Alternative C would make a negligible contribution to these beneficial effects on grasslands and nectar-feeding bats. The overall beneficial cumulative effect on listed and sensitive bat species in the region would range up to moderate.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits to threatened and endangered or sensitive species in the memorial.

The ground-disturbing activities of developing buildings and trails and more road access into grasslands north of the main road would disturb vegetation and small mammals and reptiles. This would indirectly affect the lesser long-nosed bat, the Mexican long-tongued bat, and the loggerhead shrike, but it is unlikely that these species would be adversely affected.

The activities and developments of alternative E would take place in areas unsuited for Mexican spotted owl nesting and foraging habitat; therefore, implementing alternative E might affect, but would be unlikely to adversely affect, the Mexican spotted owl.

Removing the Montezuma Ranch structures and restoring and revegetating the area would result in more habitat for agave plants and more ground cover and habitat for small rodent species. This would indirectly benefit nectar-feeding bats and loggerhead shrikes by increasing their available food.

Restoring and revegetating the ranch area after removing the structures might increase the number of agave plants, resulting in more available food for nectar-feeding bats. Revegetating the area probably would increase the habitat and prey species of the loggerhead shrikes. Thus, there would be beneficial effects on the lesser long-nosed and Mexican long-tongued bat and the loggerhead shrike, and the restoration would not be likely to adversely affect these species. Because only a small part the memorial would be affected, this alternative might affect the lesser long-nosed and Mexican long-tongued bats and the loggerhead shrike but would not be likely to adversely affect these species.

It is unlikely that Mexican spotted owls use the grazing allotments. Therefore, gazing associated with this alternative would not be likely to adversely affect this species.

Continuing grazing in the Montezuma allotment would continue negligible to minor adverse effects on vegetation and wildlife on which listed or sensitive species rely for food and habitat. Implementing alternative E would not be likely to adversely affect the lesser long-nosed bat.

Continuing grazing in the Montezuma allotment would continue negligible to minor adverse effects on vegetation and wildlife on which listed or sensitive species rely for food and habitat.

Water Quality

Analysis. Better protection of soils and vegetation through a monitoring program would lead to better protection of water quality, an overall beneficial effect on water quality under this alternative. Developing new employee housing would not affect riparian habitat, and mitigative measures would include actions to minimize erosion by stabilization with structures or vegetation. Therefore, there would be no adverse impact on water quality from building new housing.

Developing a new visitor center would remove vegetation, resulting in soil erosion and compaction in the immediate area of development. This would not be done in a riparian area, and erosion into any nearby drainages would be mitigated by the use of structures or vegetation. Therefore, the adverse effects on water quality would be negligible. Adding parking for recreational vehicles and buses would result in effects on water quality similar to those described for alternative C.

Expanding and paving Windmill Road and creating a hardened parking area would compact the soils and reduce soil permeability, leading to more surface runoff, which would make slopes more vulnerable to erosion. Paving the part of Windmill Road that parallels and traverses a stream channel might increase erosion into the channel, causing higher rates of stream sedimentation, which could cause short-term adverse effects on water quality. Those impacts would be minor, and there would be fewer long-term adverse effects on water quality because vegetation along the stream channel would recover.

Developing three new trails in grassland areas might affect water quality if the trails crossed drainages. Such trail development would lead to increased streambank erosion and sedimentation. The short-term and long-term adverse effects of new trail development on water quality would be negligible to minor because the trails would be in previously disturbed areas, and the areas affected would be small.

Removing the Montezuma Ranch structures and restoring and revegetating the area would result in effects similar to those described for alternative A.

Continuing grazing in the Montezuma allotment would result in long-term minor adverse impacts on water quality similar to those described for alternative A; however, there would be offsetting beneficial effects

from ending grazing in the Joe's Spring allotment. The adverse impacts from grazing would be partially mitigated by resting the pastures once every three years, controlling water sources and salt blocks, and using an adaptive management approach.

Cumulative Effects. Recreation, cattle grazing, ranching, road construction, water diversion, and urban development in the region all cumulatively affect soils, vegetation, and riparian environments, and consequently water quality.

Livestock grazing in riparian areas in upland communities would continue to affect water quality downstream on a reduced basis by reducing water infiltration and increasing runoff, erosion, sedimentation, and turbidity. The compaction of soils in grazed areas would continue to lead to reduced water infiltration and increased runoff, erosion, and sediment delivery to streams.

Continuing some grazing in the national memorial would contribute cumulatively to adverse effects on water quality. However, with the *Livestock Management Plan* in use, the effects of grazing in the memorial would be minimal in relation to other development and agricultural activities in the area. The effects on soils, vegetation, and riparian habitat in the memorial resulting from the actions of alternative E would add little to the regional cumulative effects on water quality compared to the disturbance occurring in other parts of the region.

Both allotments in the national memorial drain into the San Pedro River in either the United States or Mexico. The Arizona Department of Environmental Quality monitors water quality in the San Pedro River at a station approximately 9 miles east of the memorial and less than 4 miles north of the international boundary. The Environmental Protection Agency has classified portions of the San Pedro River between the Mexico border and Charleston Arizona as impaired under section 303d of the Clean Water Act because of turbidity levels that exceed water quality standards (AZ Dept. of Env. Qual. 1998). Over five years, 10%–25% of the samples taken exceeded the turbidity standard for the designated uses of aquatic life, wildlife, full body contact, and agriculture irrigation/livestock water. However, the sources have been attributed to natural processes and grazing outside Arizona's jurisdiction.

The paths that have been created near the smuggling route for undocumented aliens and illegal drugs would continue to adversely affect riparian habitats through trampling of vegetation and increased erosion. This, coupled with the adverse impacts from grazing, would continue under alternative E, cumulatively affecting riparian habitat and consequently water quality.

Conclusion. No adverse effects on water quality would be anticipated from developing additional employee housing. The establishment of monitoring programs in the memorial to monitor activities such as grazing would benefit overall water quality in the memorial.

The long-term effects on water quality from developing a new visitor center would be negligible because the development would not take place in a riparian area or along drainages, and mitigative measures would reduce soil erosion.

Removing the Montezuma Ranch structures and restoring and revegetating the area would result in negligible long-term beneficial effects on water quality.

Paving Windmill Road would result in minor long-term adverse impacts on water quality because the amount of stream channel affected would be small. Road and trail development would result in negligible to minor long-term adverse impacts on water quality.

Continuing grazing in the Montezuma allotment would result in minor long-term

adverse impacts on riparian habitats and consequently on water quality, but the effects would be offset by eliminating grazing in the Joe's Spring allotment.

Wildlife

Analysis. Through knowledge gained from an inventory and monitoring program, national memorial staff could better protect wildlife habitat. Educating the public with interpretive materials could reduce impacts on wildlife and habitat from visitor use. Overall, developing interpretive programs would result in a beneficial effect on wildlife.

New employee housing would affect wildlife in that mobile animals would move during development to similar adjacent habitats, and slow or sedentary animals such as some reptiles, amphibians, and small mammals might be lost. For animal species that are common in the memorial, the construction would have negligible adverse effects. The rare or uncommon species that are slow or sedentary, particularly amphibians and reptiles, would be more susceptible to adverse effects from construction. However, with mitigating measures to reduce the potential loss of individuals of rare or uncommon species, the long-term adverse effects on wildlife would be negligible to minor.

Developing a new visitor center about 1 mile north of the main road would not affect any rare or uncommon species, which do not inhabit that area, according to national memorial surveys. Construction would compact soils and remove vegetation, which would result in the loss of habitat and foods for wildlife, but the short-term adverse effects on wildlife would be negligible because the affected area would be small.

Widening and paving Windmill Road would adversely affect wildlife in ways similar to those described for East Forest Lane in alternative D. Developing two new trails in the grassland north of the main road would cause negligible effects on wildlife; no rare or uncommon species are known to inhabit this area. However, wildlife would be adversely affected by increased human presence made possible by the access to the new visitor center, the paved road, and the new trails. There has been little previous human use of this habitat, and the presence of people and vehicles would cause animals to use more energy, so increased road access might cause the loss of individual animals and the fragmentation of populations. Thus, these developments in previously undisturbed areas would result in a loss of habitat value, but the area is small and does not contain uncommon species, so the adverse effects of alternative E on wildlife would be negligible to minor. Some benefits to individual animals in the memorial might result from trail and road development by facilitating movement within the memorial, which might reduce individual animal's energy expenditure. The long-term benefits to wildlife from these developments would likely be negligible.

As in alternative B, removing the Montezuma Ranch structures and restoring and revegetating the area would result in more ground cover and habitat for small rodent species. The structure removal would cause short-term negligible adverse effects on wildlife. Mitigating measures would be used to prevent or reduce the effects on rare or uncommon wildlife species. Restoring and revegetating the site with native vegetation after the structures were removed would offset the adverse impacts on soils and improve grassland habitat, benefiting wildlife species.

Eliminating grazing from the Joe's Spring allotment and continuing it in the Montezuma allotment (reducing the area grazed in the memorial by 25%) would increase grassland habitat and forage for wildlife, particularly benefiting small mammals and their predators. The reduced effects on riparian vegetation from reduced grazing would increase cover and nesting habitat, benefiting such species as migrating birds, deer, and predators that use drainages as wildlife corridors. The long-term

effects on wildlife in the national memorial would be minor.

Cumulative Effects. A fence built by the U.S. Border Patrol at the southern edge of Coronado National Memorial, newly installed lighting, and improvements to the dirt road there would have the potential to affect wildlife migration, access to water, and the movements of nocturnal species in local areas. Changes in the road would make travel at greater speeds possible, posing a threat to wildlife by collision. This project could adversely affect wildlife in the memorial, especially larger species adapted to moving over large tracts of land. Implementing alternative A would not contribute cumulatively to the adverse effects of the Border Patrol project.

Developments by the border patrol to improve roads and install fencing and lighting adversely affect wildlife by impeding movement, altering feeding patterns, and reducing habitat quality for nesting and feeding. Development, grazing, and loss of habitat in areas adjacent to the national memorial and in the San Pedro River valley might result in the loss of more wildlife species from the memorial. Timber harvesting and hunting in the adjacent Coronado National Forest would reduce available wildlife habitat, alter animal behaviors, and results in the removal of individuals. Although thought to be rare in the memorial, poaching of reptiles and amphibians results in a loss of individuals and may reduce populations of rare or uncommon species in the region. Development within the national memorial including new employee housing which would result in the loss of a small portion of wildlife habitat would contribute negligibly to the adverse cumulative effects of these other regional activities.

The efforts by the National Park Service to educate the public about the natural environment would support other local and regional entities efforts to conserve and enhance the protection of natural resources in the area. Programs within the region including the memorial that enhance public awareness of the natural environment help to protect sensitive areas such as riparian areas. Protection of these areas conserve wildlife habitat and benefit wildlife within the region.

As described in alternative B, grassland restoration in Fort Huachuca is being used to improve the ecological integrity and function of native grasslands, and prescribed burning on private and public lands in the area is used to maintain grasslands. The actions of alternative E would contribute cumulatively to these regional beneficial effects on grasslands except that one grazing allotment would remain active.

As described in alternative B, in combination with forest conservation actions in the isolated mountains of southeastern Arizona and in the San Pedro River National Conservation Area, the actions of alternative E would benefit both migratory birds and larger, dispersing animals that require more forest habitat to sustain viable populations. The Upper San Pedro Valley is a major neotropical migrant bird corridor. Woodlands and forest habitats in the Huachuca Mountains and in the San Pedro River National Conservation Area are important habitat resources for migrating birds.

Proposed management actions at Fort Huachuca and activities in the Coronado National Forest (such as snag and nest tree protection and wildfire management) would sustain biologically and structurally diverse habitat for migrating or dispersing wildlife in the Huachuca Mountains, as described in alternative B. The actions of alternative E would complement these efforts to maintain wildlife corridors and riparian areas and conserve native grasslands.

Conclusion. Programs to interpret, document, and inventory memorial resources and uses would result in a long-term negligible benefits on threatened and endangered or sensitive species in the

memorial. Loss of a small portion of wildlife habitat and the potential for loss of sedentary individual animals from development of new employee housing would have long-term negligible to minor adverse effects.

Developing buildings, trails, and roads under alternative E would result in the loss of habitat and individual animals and the fragmentation of populations. This represents a loss of habitat value, but because the affected grassland area would be small and does not contain uncommon species, the adverse effects on wildlife would be negligible. Trails and road development might benefit individuals of some species by facilitating movement.

Removing the Montezuma Ranch structures, with mitigation to reduce the adverse effects on rare or uncommon species, would result in long-term negligible adverse effects on wildlife. Restoring and revegetating the ranch area would improve grassland habitat, benefiting wildlife. Eliminating grazing from the Joe's Spring allotment would increase forage and habitat in grassland and riparian areas, a long-term beneficial effect for wildlife.

Impairment

The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to air quality; cave resources, soils; vegetation; threatened, endangered, or sensitive species; water quality; or wildlife would result from implementing alternative E.

UNAVOIDABLE ADVERSE IMPACTS

All the alternatives would result in adverse impacts on soils, with the level of impact varying at the site level. However, when the impacts on soils are compared to the size of the memorial, they would be negligible, because less than 1% of memorial soils would be affected in all alternatives.

Vegetation and soils would be removed when small areas were graded to build new facilities, expand existing structures, add parking lots and pullouts, or pave roads and develop trails. Alternatives B, C, D, and E would result in these unavoidable adverse effects with varying degrees, depending on the amount of development.

None of the alternatives would result in unavoidable adverse impacts on the endangered Mexican spotted owl or long-nosed bat, or on species of special concern, including the Mexican long-tongued bat and the loggerhead shrike.

Water quality would be adversely affected by development or by upgrading trails in alternatives B, C, and D. The loss of riparian vegetation and increased soil erosion in each of these alternatives would cause negligible to minor adverse impacts on water quality. Road construction in alternatives D and E would adversely affect water quality, but the effects would be negligible to minor because the areas affected would be small and mitigating measures would control erosion. Grazing in riparian habitats would continue to affect water quality in alternative A, and to a lesser extent in alternatives D and E, in which only one allotment would be grazed.

Construction would disturb wildlife species under all the action alternatives. Paving roads and parking areas under alternatives D and E would adversely affect wildlife. Developing a new visitor center in a previously undisturbed

grassland area (alternative E) would result in minor adverse effects on wildlife.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The erosion of soils that would result from developing facilities and trails, installing impervious surfaces, or removing Montezuma Ranch structures would be an irreversible loss because soils in this area form slowly.

RELATIONSHIPS OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Developing trails, constructing visitor and operation facilities, and demolishing structures could cause short-term adverse impacts on soils when soils were exposed to wind or rain, resulting in higher rates of erosion. However, in the long term, restoring and revegetating sites in alternatives A, B, C, and E and eliminating some or all grazing from the memorial under alternatives B, C, D, and E would result in long-term saving of resources and enhance the preservation of soils. All the alternatives would result in long-term beneficial effects on soils, with the beneficial effects from alternative C being the greatest.

Developments or expanding and upgrading existing facilities would permanently remove vegetation. Vegetation also could be degraded by continuing grazing (alternatives A, D, and E) and by constructing new facilities or trails in previously undeveloped areas (alternatives B, D, and E). However, these effects would not result in the loss of long-term productivity of vegetation in the memorial. Although vegetation would be lost under all the alternatives, there would be no adverse impacts on agave populations or common small mammal species (which, if they were to occur, could adversely affect the productivity of lesser long-nosed bats, Mexican long-tongued bats, or loggerhead shrikes).

Short-term adverse impacts on water quality and riparian habitat could result from developing or upgrading trails (alternatives B, C, D, and E) or roads (alternatives D and E), when soils and vegetation in riparian habitats were disturbed. However, restoring and revegetating sites (alternatives A, B, C, and E) and eliminating some or all grazing from the national memorial (alternatives B, C, D, and E) would save resources and enhance the national memorial's water quality and the preservation of wetland resources in the long term.

Building a new visitor center in the grasslands under alternative E would permanently remove wildlife habitat. Developing roads and trails to provide access to areas previously little used by visitors would degrade wildlife habitat under alternatives B, D, and E.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Building new structures would increase energy requirements. Long-term energy demands would be mitigated by designing all structures to be energy efficient. Alternatives D and E, with the most structures to be maintained and used, would result in the greatest energy requirements.

EFFECTS ON CULTURAL RESOURCES

ALTERNATIVE A

Archeological Resources

Analysis. A series of archeological surveys has been and continues to be undertaken at the national memorial to meet the requirements of EO 11593. These surveys have identified prehistoric lithic scatter plots, isolated artifacts, and historic sites throughout the national memorial. These sites have not been completely evaluated, but NPS personnel continue to complete site research to identify and protect archeological features. These surveys and resource documentation are improving the national memorial's ability to make informed management decisions about the identification and location of archeological resources. The continuing identification and location of archeological resources would result in their being preserved in place, a negligible long-term beneficial effect.

Some archeological surveys of the 82-acre Montezuma Ranch have been completed in the orchards and the pool area. The area around the main ranch structures has been altered by ground-disturbing activities caused by the development of dude ranch facilities, working ranch structures, and a large modern residence now under construction. Other ground-disturbing activities in that area over the years have been the construction of roads and corridors for water and electrical utilities, as well as the planting of an orchard and various ornamental trees and shrubs. Coronado National Memorial would conduct an archeological survey of the area. The identification and location of any archeological resources in the ranch area would result in their being preserved in place, a negligible long-term beneficial effect.

Grazing on the two allotments (1,811 acres) has disturbed archeological sites by livestock. The recently implemented *Livestock Management Plan* (NPS 2000b) is reducing but will not eliminate disturbance to archeological sites by cattle. The continued disturbance of archeological sites by cattle would result in a long-term minor to moderate adverse impact on archeological resources.

Cumulative Effects. Cattle grazing, which began before the national memorial was established, continues to disturb surface archeological resources, affecting such resources in the memorial's land. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. Cochise County plans for increased growth in the Southern San Pedro Valley, with some restriction on the scale and density of the development. These actions, added to the limited scope of Coronado National Memorial's efforts in preservation and development, could result in long-term negligible beneficial effects on the area's archeological resources.

Conclusion. An archeological survey would be undertaken at the Montezuma Ranch. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and protect archeological resources would benefit archeological resources, but such resources would be adversely affected by the continuation of grazing. The overall result would be a long-term negligible adverse impact on the national memorial's archeological resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific

purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of archeological resources or values would result from implementing alternative A.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the national memorial under alternative A would have an effect that would not be adverse. All national memorial resources that have been determined eligible for nomination to the National Register of Historic Places (International Boundary Monuments 100, 101, and 102 and the Montezuma Pass road) would not be adversely affected by the actions of this alternative.

Historic Structures

Analysis. The Montezuma Ranch structures have not been evaluated for eligibility for listing on the National Register of Historic Places. The national memorial is consulting with the Arizona state historic preservation office about this, but a formal determination of eligibility has not been completed. The staff of the national memorial is gathering documentation to submit to the Arizona state historic preservation office so that a formal determination of eligibility can be completed for the ranch structures. After completion of the determination, the structures not eligible for listing would be torn down; this would result in no effect. The structures determined to be eligible, if any, would be stabilized and preserved, resulting in a long-term minor beneficial effect on archeological resources.

The existing visitor center has not been formally evaluated for its eligibility for national register listing, but its status as a "Mission 66" structure makes it potentially eligible. At present there are no plans to do anything other than routine maintenance on the visitor center. If any substantial work was to be done on the visitor center, the national memorial staff would undertake the determination of its national register eligibility. If it was determined not to be eligible, the work would result in no effect. If it was determined to be eligible, the structure would be preserved, resulting in a long-term minor beneficial effect.

Cumulative Effects. Before the Historic Preservation Act was passed in 1966, various mining and ranch structures on lands now in the national memorial were removed or neglected, but since the act was passed, the memorial has identified historic structures and now works toward their preservation. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the limited scope of Coronado National Memorial's preservation efforts, could result in long-term negligible beneficial effects on the area's historic structures.

Conclusion. Before taking any action regarding the Montezuma Ranch structures, the national memorial staff would pursue a formal determination of the structures' eligibility for the National Register of Historic Places. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and preserve historic structures would benefit these resources. The overall result would be a long-term negligible to minor beneficial effect on the memorial's historic structures.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to historic structures would result from implementing alternative A.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the national memorial under alternative A would have an effect that would not be adverse.

Ethnographic Resources

Analysis. The national memorial staff would continue to develop inventories for ethnographic resources to understand and manage these resources. As areas for gathering acorns and other items important to the American Indian culture become scarce, the use of the national memorial by American Indians might increase. There would be no change in the way American Indian groups are accommodated at the memorial; therefore, the result would be a long-term negligible beneficial effect.

Under this no-action alternative, the current programs of the national memorial would continue. These programs lack depth and range; therefore, visitors would continue to receive a limited understanding and appreciation of the Indian and Hispanic viewpoints about the Coronado Expedition.

Cumulative Effects. Until recently, Coronado National Memorial has made no attempt to identify ethnographic resources; however, it is now in the process of identifying and protecting those resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of development. However, growth might adversely affect ethnographic resources. The county has identified scenic corridors and conservation easement areas that could protect ethnographic resources. These actions, added to the limited scope of the national memorial's preservation efforts, could result in a long-term negligible adverse impact on the area's ethnographic resources.

Conclusion. American Indians would continue gathering items important to their culture on the national memorial's lands. The long-term minor beneficial effect from developing inventories for ethnographic resources would be partially offset by a lack of in-depth programs, resulting in an overall long-term negligible beneficial effect on ethnographic resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of ethnographic resources or values would result from implementing alternative A.

Cultural Landscapes

Analysis. The national memorial would continue routine maintenance activities on its facilities and infrastructure (roads, picnic

areas, housing, administrative and visitor facilities, buildings). No new structures, roads, or trails would be added under this no-action alternative, but old structures would be rehabilitated as funding became available. This would preserve any potential cultural landscapes. One of the three cultural landscapes has been formally evaluated — a level I cultural landscape inventory has been completed for the Montezuma Ranch. The present actions of the national memorial to provide only maintenance would result in a long-term beneficial effect on cultural landscapes.

An evaluation of abandoned mining areas (all sites considered one landscape) and the entire memorial viewshed would be completed in future years. However, it is recognized through legislation that the views from Montezuma Pass are important to the national memorial's mission. Construction in the memorial would be done in a way that would protect the views from Montezuma Pass. Outside the national memorial, development of various types in the United States and Mexico threatens to degrade the views from Montezuma Pass. As funding permitted, the national memorial's cultural landscapes would be identified, and treatment would be developed for the preservation of these landscapes. The preservation of the memorial's cultural landscapes would be a long-term minor beneficial effect.

A cultural landscape inventory has been completed at the 82-acre Montezuma Ranch. NPS cultural landscape experts have made a preliminary determination that the ranch's cultural landscape lacks integrity and would not meet the criteria for listing on the National Register of Historic Places. The national memorial is consulting with the Arizona state historic preservation office about this, but a formal determination of eligibility has not been completed for this site. The Montezuma Ranch structures, which can be seen from Montezuma Pass, are visually intrusive on views from the national memorial into Mexico. Removing the structures would result in a long-term minor beneficial effect on the views from Montezuma Pass.

Cumulative Effects. Coronado National Memorial has recognized the importance of the CCC roadwork from the past and is treating the Montezuma Pass road as a significant cultural landscape. Coronado National Forest plans to maintain and enhance visual resource integrity. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development to lessen the visual impact. In addition, the county has identified scenic corridors and conservation easement areas. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the limited preservation efforts in the national memorial, could result in long-term negligible to minor beneficial effects on the region's cultural landscapes.

Conclusion. Until the Montezuma Ranch structures were removed, they would have short-term negligible adverse impacts on national memorial views. Development outside the national memorial could result in minor to moderate short-term and long-term adverse impacts on cultural landscapes.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of cultural landscapes would result from implementing alternative A.

Section 106 Summary. Under the regulations of the Advisory Council on Historic

Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the activities of the national memorial under alternative A would have an effect on cultural landscapes that would not be adverse.

ALTERNATIVE B

Archeological Resources

Analysis. The ground-disturbing activities of alternative B — building an annex to the visitor center, adding parking facilities, developing new trails — would disturb little new area. Surveys have not found any archeological sites that could not be avoided in the areas of these developments, but currently unknown archeological resources could exist there. If archeological resources were found, actions would be taken to protect them (see "Mitigating Measures," p. 65). Building the annex to the visitor center would not affect archeological resources. At the beginning of design planning, further evaluation of the developments would be necessary, with archeological surveys of the areas selected for development. Based on these surveys, development would be designed not to affect archeological resources.

Eliminating grazing from the memorial (1,811 acres) would end the disturbances of archeological resources by cattle. Compared to the no-action alternative, this would result in a long-term minor beneficial effect on archeological resources.

The management prescriptions of alternative B, with more than 75% of the national memorial in the conservation prescription and 15 % in the education prescription, with development concentrated in previously disturbed areas, would cause little disturbance of archeological sites. These management prescriptions would result in long-term minor beneficial effects on archeological resources.

Cumulative Effects. Cattle grazing would continue to disturb surface archeological resources outside the memorial. Coronado National Forest plans to continue developing inventories and using them to preserve and interpret cultural resources. Cochise County plans for increased growth in the southern San Pedro Valley, with some restriction on the scale and density of the development. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the limited development that would take place in the national memorial under alternative B, could result in long-term negligible adverse impacts on archeological resources in the region.

Conclusion. New development in the national memorial under alternative B would be minor, taking place primarily in previously disturbed areas. The impacts on archeological resources would be partially or fully mitigated by sensitive siting and by designing facilities in relation to the resources. Ending grazing in the national memorial would help to conserve archeological resources. Therefore, alternative B would result in a long-term negligible to minor beneficial effect on archeological resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of archeological resources or values would result from implementing alternative B.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park

Service finds that the activities of alternative B would not have an adverse effect on archeological resources. All national memorial resources that have been determined eligible for nomination to the National Register of Historic Places (International Boundary Monuments 100, 101, and 102 and the Montezuma Pass road) would not be adversely affected by the actions of alternative B.

Historic Structures

Analysis. A formal determination of eligibility for listing on the National Register of Historic Places has not been completed for the various Montezuma Ranch structures. The staff of the national memorial is consulting with the Arizona state historic preservation office about evaluating the structures for their eligibility. The staff is gathering documentation to submit to the Arizona state historic preservation office so that a formal determination of eligibility can be completed. Any structures found ineligible for listing would be torn down; this would result in no effect. The structures determined to be eligible, if any, would be stabilized and preserved, resulting in a long-term minor beneficial effect on this archeological resource.

The memorial's visitor center has not been formally evaluated for its eligibility for listing on the national register, but its status as a "Mission 66" structure makes it potentially eligible. The structure would be evaluated for eligibility before any rehabilitation work could begin. If it was found eligible, the rehabilitation and construction proposed in this alternative would be done in a way that would not adversely effect significant features and values.

Cumulative Effects. Before the Historic Preservation Act was passed in 1966, various mining and ranch structures on lands now in the national memorial were removed or neglected, but since the act was passed, the memorial has identified historic structures and now works toward their preservation. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the limited scope of Coronado National Memorial's preservation efforts, could result in long-term negligible beneficial effects on the area's historic structures.

Conclusion. Before taking any action regarding the visitor center or the Montezuma Ranch structures, the national memorial staff would pursue a formal determination of the structures' eligibility for the National Register of Historic Places. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and preserve historic structures would benefit these resources. The overall result would be a long-term negligible beneficial effect on the national memorial's historic structures.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Therefore, no impairment of resources or values related to historic structures would result from implementing alternative B.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the

national memorial under alternative B would have an effect that would not be adverse.

Ethnographic Resources

Analysis. The emphasis on developing various partnerships for understanding the cultural impacts of the Coronado Expedition would add to the appreciation of ethnographic resources in the vicinity. Festival and events sponsored by the national memorial would help to foster appreciation and understanding of various cultures; the effects of this would reach beyond the national memorial's boundaries The memorial's educational and interpretive programs would promote the protection of tangible and intangible resources in the vicinity. These actions would result in a long-term moderate to major beneficial effect.

The actions in alternative B would not affect known ethnographic uses of national memorial resources. New developments would be minor, and any effect they would have on ethnographic resources would be partially or fully mitigated by sensitive siting and design of facilities. Managing most of the national memorial lands in the conservation (75%) or education (15%) prescriptions would protect and preserve ethnographic resources. Therefore, the long-term beneficial effects of alternative B on ethnographic resources would be moderate to major.

Cumulative Effects. Until recently, Coronado National Memorial has made no attempt to identify ethnographic resources; however, it is now in the process of identifying and protecting those resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of development. However, growth might affect ethnographic resources. The county has identified scenic corridors and conservation easement areas, and this could protect ethnographic resources. These actions, added to the national memorial's efforts to preserve ethnographic resources, could result in long-term moderate to major beneficial effects on the understanding and appreciation of ethnographic resources.

Conclusion. No action or development in alternative B would affect known ethnographic resources. The various programs and partnerships that the national memorial would develop to emphasize the area's multicultural heritage would result in long-term moderate to major beneficial effects on ethnographic resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of ethnographic resources would result from implementing alternative B.

Cultural Landscapes

Analysis. Removing the Montezuma Ranch structures and restoring and revegetating the area would enhance the views from Montezuma Pass, making them more representative of the time of the Coronado Expedition. Revegetating abandoned roads and powerline areas would improve cultural landscapes. The visitor center annex would be designed not to affect cultural landscapes, and a cultural landscape report would be undertaken before the building was designed so that areas of the national memorial containing cultural landscapes could be determined and treatment procedures recommended. This report also would guide the location and design of employee housing so as to minimize the effects on cultural landscapes.

None of the proposed development would affect NPS structures and features already identified on the national memorial's list of classified structures as meriting preservation. Managing most of the national memorial lands in the conservation (75%) or education (15%) prescriptions would protect and preserve potential cultural landscapes. The long-term beneficial effects on cultural landscapes from alternative B would be minor to moderate.

Cumulative Effects. Coronado National Memorial has recognized the importance of the CCC roadwork from the past and is now treating the Montezuma Pass road as a significant cultural landscape. Coronado National Forest plans to maintain and enhance the integrity of visual resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development to reduce visual impacts, and the county has identified scenic corridors and conservation easement areas. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. Less development would reduce but not eliminate impacts on cultural landscapes. These actions, added to the national memorial's efforts to preserve and enhance cultural landscapes, could result in long-term minor beneficial effects on the area's cultural landscapes.

Conclusion. The developments of alternative B would be minimal, and the impacts on cultural landscapes would be partially or fully mitigated by sensitive siting and design, augmented by other protective measures such as vegetative screening. This alternative would result in long-term minor to moderate beneficial effects on cultural landscapes.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of cultural landscapes would result from implementing alternative B.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative B would not adversely affect cultural landscapes.

ALTERNATIVE C

Archeological Resources

Analysis. Limiting ground-disturbing activities to previously disturbed areas and keeping 90% of the national memorial in the conservation prescription would make it possible to preserve resources for future scientific study. This would be a long-term minor to moderate beneficial effect.

Eliminating grazing from the memorial would relieve archeological resources in both allotments (1,811 acres) from disturbance by cattle, a long-term minor to moderate beneficial effect.

Cumulative Effects. Cattle grazing would continue to disturb surface archeological resources outside the memorial. Coronado National Forest plans to continue inventories and use the information to preserve and interpret cultural resources. Cochise County plans for increased growth in the southern San Pedro Valley, with some restriction on the scale and density of the development. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, along with the national

memorial's limited development, could result in long-term negligible to minor beneficial effects on the area's archeological resources.

Conclusion. Archeological resources probably would not be affected under alternative C, with development in the national memorial limited and most of it taking place in previously disturbed areas. Therefore, alternative C would result in long-term negligible to minor beneficial effects on archeological resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of archeological resources would result from implementing alternative C.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative C would not adversely affect archeological resources. All national memorial resources that have been determined eligible for nomination to the National Register of Historic Places (International Boundary Monuments 100, 101, and 102 and the Montezuma Pass road) would not be adversely affected by the actions of this alternative.

Historic Structures

Analysis. A formal determination of eligibility for listing on the National Register of Historic Places has not been completed for the various Montezuma Ranch structures. The staff of the national memorial is consulting with the Arizona state historic preservation office about evaluating the structures for their eligibility. The staff is gathering documentation to submit to the Arizona state historic preservation office so that a formal determination of eligibility can be completed. Any structures found ineligible for listing would be torn down; this would result in no effect. The structures determined to be eligible, if any, would be stabilized and preserved, resulting in a long-term minor beneficial effect on this historic resource.

The memorial's visitor center has not been formally evaluated for its eligibility for listing on the national register, but its status as a "Mission 66" structure makes it potentially eligible. A determination of its eligibility would be completed to guide the rehabilitation work on the building's interior. If it was found not to be eligible, there would be no effect. If it was found eligible, the rehabilitation proposed in this alternative would result in a long-term moderate beneficial effect.

Cumulative Effects. Before the Historic Preservation Act was passed in 1966, various mining and ranch structures on lands now in the national memorial were removed or neglected, but since the act was passed, the memorial has identified historic structures and now works toward their preservation. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the limited scope of Coronado National Memorial's preservation efforts, could result in long-term negligible beneficial effects on the area's historic structures.

Conclusion. Before taking any action regarding the visitor center or the Montezuma Ranch structures, the national memorial staff would pursue a formal determination of the

structures' eligibility for the National Register of Historic Places. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and preserve historic structures would benefit these resources. The overall result would be a long-term negligible beneficial effect on the national memorial's historic structures.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to historic structures would result from implementing alternative C.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the national memorial under alternative C would have an effect that would not be adverse.

Ethnographic Resources

Analysis. None of the actions of alternative C, which would involve little development, would interfere with the primary ethnographic use of the national memorial by American Indians. Restoring natural contours and vegetation could make more areas suitable for ethnographic use. Therefore, alternative C would result in long-term negligible to minor beneficial effects on ethnographic resources.

Cumulative Effects. Until recently, Coronado National Memorial has made no attempt to identify ethnographic resources; however, it is now in the process of identifying and protecting those resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development. However, such growth might adversely affect ethnographic resources. The county has identified scenic corridors and conservation easement areas, which could protect ethnographic resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, along with the national memorial's preservation efforts and minimal development under alternative C (which would avert the disturbance of ethnographic resources) could result in long-term negligible to minor beneficial effects on the area's ethnographic resources.

Conclusion. The lack of development in the form of trail, roads, and buildings in alternative C would protect the national memorial's ethnographic resources from disturbance. Restoring and revegetating areas of powerlines, roads, and nonhistoric structures would make more areas suitable for ethnographic use. All these actions combined would result in long-term negligible to minor beneficial effects on ethnographic resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of ethnographic resources would result from implementing alternative C.

Cultural Landscapes

Analysis. Having more than 90% of the national memorial in the conservation management prescription under alternative C would mean that areas would be managed to preserve resources for future scientific study. This alternative would restore cultural landscapes to their condition at the time of the Coronado Expedition, a long-term negligible to minor beneficial effect.

Cumulative Effects. Coronado National Memorial has recognized the importance of the CCC roadwork from the past and is now treating the Montezuma Pass road as a significant cultural landscape. Coronado National Forest plans to maintain and enhance visual resource integrity. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development to reduce visual impacts, and the county has identified scenic corridors and conservation easement areas. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the national memorial's efforts to preserve and enhance cultural landscapes, could result in long-term minor beneficial effects on the region's cultural landscapes.

Conclusion. The limited development proposed in alternative C would result in the restoration of landscapes to be representative of the time of the Coronado Expedition; therefore, this alternative would result in long-term negligible to minor beneficial effects on cultural landscapes.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of cultural landscapes would result from implementing alternative C.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative C would not have an adverse effect on cultural landscapes.

ALTERNATIVE D

Archeological Resources

Analysis. Surveys at the national memorial have not found any archeological sites that could not be avoided by careful planning for the following ground-disturbing actions of alternative D:

- removing the Montezuma Ranch structures and building an educational center or adaptively using the structures
- adding a paved parking area and road to the ranch site
- rebuilding and paving East Forest Lane
- building a paved parking area and a commemorative feature at the end of East Forest Lane
- expanding the visitor center and adding more parking
- upgrading the road to the picnic area and adding picnic sites
- developing four new trails

About 70% of these actions would take place in previously disturbed areas and the rest in undisturbed areas. There could be unknown archeological resources in the areas that would be disturbed, and if any were found, actions would be taken for their protection. (see "Mitigating Measures," p. 65). None of

the above actions would be expected to affect known archeological resources.

The increased accessibility by trail and paved road in the grasslands could result in vandalism to archeological resources in those areas. Further evaluation would be necessary when design planning for the developments was begun, with archeological surveys undertaken in the areas selected for development. The designs of developments would be based on the surveys to minimize the impacts on resources. The continuing identification and location of archeological resources would result in their being preserved in place, a negligible long-term beneficial effect.

Continuing grazing in the Joe's Spring allotment (1,143 acres) would make it possible that archeological resources, mainly lithic scatters, could be disturbed by cattle, but eliminating grazing from the Montezuma allotment would remove the possibility of grazing disturbance on 668 acres. Ground disturbance would be limited by the management prescriptions of this alternative, with more than 80% of the national memorial in the conservation prescription and 10 % in the education prescription. The actions of alternative D would result in a negligible to minor long-term adverse impact on archeological resources.

Cumulative Effects. Cattle grazing would continue to disturb surface archeological resources outside the memorial. Coronado National Forest plans to continue inventorying, preserving, and interpreting cultural resources. Cochise County plans for increased growth in the southern San Pedro Valley, with some restriction on the scale and density of the development. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to increased development in the national memorial, could result in long-term minor adverse impacts on the area's archeological resources.

Conclusion. Much of the new development in Coronado National Memorial under alternative D would be limited to previously disturbed areas. The large number of ground-disturbing actions in this alternative would increase the possibility of affecting archeological resources. Overall, the actions of this alternative would result in a long-term negligible adverse impact on archeological resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of archeological resources would result from implementing alternative D.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative D would not have an adverse effect on archeological resources. All national memorial resources that have been determined eligible for nomination to the National Register of Historic Places (International Boundary Monuments 100, 101, and 102 and the Montezuma Pass road) would not be adversely affected by the actions of alternative D.

Historic Structures

Analysis. A formal determination of eligibility for listing on the National Register of Historic Places has not been completed for the various Montezuma Ranch structures. The staff of the national memorial is consulting with the Arizona state historic preservation office

about evaluating the structures for their eligibility. The staff is gathering documentation to submit to the Arizona state historic preservation office so that a formal determination of eligibility can be completed. Any structures found ineligible for listing would be torn down; this would result in no effect. The structures determined to be eligible, if any, would be stabilized and preserved, resulting in a long-term minor beneficial effect on this resource.

The memorial's visitor center has not been formally evaluated for its eligibility for listing on the national register, but its status as a "Mission 66" structure makes it potentially eligible. A determination of its eligibility would be completed to guide the rehabilitation work on the building's interior. If it was found not to be eligible, there would be no effect. If it was found eligible, the rehabilitation proposed in this alternative would result in a long-term moderate beneficial effect.

Cumulative Effects. Before the Historic Preservation Act was passed in 1966, various mining and ranch structures on lands now in the national memorial were removed or neglected, but since the act was passed, the memorial has identified historic structures and now works toward their preservation. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to Coronado National Memorial's limited preservation efforts, could result in long-term negligible beneficial effects on the area's historic structures.

Conclusion. Before taking any action regarding the visitor center or the Montezuma Ranch structures, the national memorial staff would pursue a formal determination of the structures' eligibility for the National Register of Historic Places. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and preserve historic structures would benefit these resources. The overall result would be a long-term negligible beneficial effect on the national memorial's historic structures.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to historic structures would result from implementing alternative D.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the national memorial under alternative D would have an effect that would not be adverse.

Ethnographic Resources

Analysis. New and upgraded trails and roads under alternative D would improve access to and within the national memorial, bringing visitors to previously little visited areas. Restoring natural contours and revegetating the areas of powerlines and abandoned roads would not interfere with the ethnographic use of the national memorial by American Indians. The long-term effects of alternative D on ethnographic resources would be negligible and beneficial.

Cumulative Effects. Until recently, Coronado National Memorial has made no

attempt to identify ethnographic resources; however, it is now in the process of identifying and protecting those resources. Coronado National Forest plans to protect ethnographic resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development; however, such growth might adversely affect ethnographic resources. The county has identified scenic corridors and conservation easement areas that could protect ethnographic resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the actions of Coronado National Memorial under alternative D, would result in long-term negligible beneficial effects on the area's ethnographic resources.

Conclusion. The possibility of affecting ethnographic resources would be greater in alternative D than in some of the other alternatives because there would be greater access to areas of the national memorial. The actions in this alternative could result in a long-term negligible beneficial effect on ethnographic resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of ethnographic resources would result from implementing alternative D.

Cultural Landscapes

Analysis. Reestablishing natural contours and revegetating the areas of abandoned powerlines and roads could affect cultural landscapes, as could road and trail building and removing nonhistoric structures. None of the roads, trails, or structures has been identified as being part of cultural landscapes; therefore, these actions would not cause effects on cultural landscapes.

With more than 80% of the national memorial in the conservation prescription and 10 % in the education prescription, the views that represent the way the country looked to the Coronado Expedition would be perpetuated. Even though the siting, design, and vegetative screening of the new facilities and roads would be done with care, vehicles on the roads and in the parking lots still could be visually intrusive from Montezuma Pass. Cultural landscapes would be protected during the expansion and rehabilitation of the visitor center and the construction of employee housing. The actions of alternative D would result in a negligible long-term adverse effect on cultural landscapes.

Cumulative Effects. Coronado National Memorial has recognized the importance of the CCC roadwork from the past and is now treating the Montezuma Pass road as a significant cultural landscape. Coronado National Forest plans to maintain and enhance the integrity of its visual resources. Cochise County plans for increased growth in the southern San Pedro River Valley, but with guidelines on the scale, density, location, and type of the development to reduce visual impacts. In addition, the county has identified scenic corridors and conservation easement areas. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the national memorial's actions under alternative D that might adversely affect cultural landscapes, could result in long-term negligible adverse impacts on the area's cultural landscapes.

Conclusion. The possibility of adversely affecting cultural landscapes would be greater in this alternative than in some of the other

action alternatives because of the variety of actions (constructing roads, facilities, and trails) that would take place. The actions of alternative D would result in a long-term negligible adverse impact on cultural landscapes.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of cultural landscapes would result from implementing alternative D.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative D would not adversely affect cultural landscapes.

ALTERNATIVE E

Archeological Resources

Analysis. Surveys at the national memorial have not found any archeological sites that could not be avoided by careful planning for the ground-disturbing actions of alternative E — building a new visitor/educational center about 0.7 mile north of the Montezuma Canyon Road, adding a paved parking area and road to the site, removing the Montezuma Ranch structures, and developing four new trails. There could be unknown archeological resources in the areas that would be disturbed, and if any were found, actions would be taken for their protection. (see "Mitigating Measures," p. 65). The continuing identification and location of archeological resources would result in their being preserved in place, a negligible long-term beneficial effect.

With about 85% of the national memorial in the conservation prescription under this alternative, and with the other 15% in the education prescription, the ground disturbance would be limited. Most of the ground disturbance would take place in grasslands north of the main road, about 10% of it in previously disturbed areas; the other 90% in previously undisturbed areas. Because the area that would be developed in this alternative contains relatively undisturbed areas, there would be a greater likelihood of finding previously unknown resources than in the other alternatives.

The increased accessibility by trail and paved road in the grasslands could result in vandalism to archeological resources in those areas. Further evaluation would be necessary when design planning for the developments was begun, with archeological surveys undertaken in the areas to be developed. Designs of developments would be based on the surveys to minimize the impacts on resources.

Continuing grazing in the Montezuma allotment (668 acres) would make it possible that archeological resources, mainly lithic scatters, could be disturbed by cattle, but eliminating grazing from the Joe's Spring allotment would remove the possibility of grazing disturbances on 1,143 acres. The continued disturbance of archeological sites by cattle would result in a long-term minor to moderate adverse impact on archeological resources.

Cumulative Effects. Cattle grazing would continue to disturb surface archeological resources outside the memorial. Coronado National Forest plans to continue inventorying resources and using the inventories to preserve and interpret cultural resources. Cochise County plans for increased growth in the southern San Pedro Valley, with some restriction on the scale and density of the

development. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to increased development in Coronado National Memorial under alternative E, could result in long-term minor adverse impacts on the area's archeological resources.

Conclusion. Much of the new development in Coronado National Memorial under alternative E would take place in previously undisturbed areas. The variety of ground-disturbing actions in this alternative would increase the possibility of affecting archeological resources. Overall, the actions of this alternative would result in a long-term negligible to minor adverse impact on archeological resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of archeological resources would result from implementing alternative E.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the national memorial's actions under alternative E would not have an adverse effect on archeological resources. All national memorial resources that have been determined eligible for nomination to the National Register of Historic Places (International Boundary Monuments 100, 101, and 102 and the Montezuma Pass road) would not be adversely affected by the actions of this alternative.

Historic Structures

Analysis. A formal determination of eligibility for listing on the National Register of Historic Places has not been completed for the various Montezuma Ranch structures. The staff of the national memorial is consulting with the Arizona state historic preservation office about evaluating the structures for their eligibility. The staff is gathering documentation to submit to the Arizona historic preservation office so that a formal determination of eligibility can be completed. Any structures found ineligible for listing would be torn down; this would result in no effect. The structures determined to be eligible, if any, would be stabilized and preserved, resulting in a long-term minor beneficial effect on this archeological resource.

The memorial's visitor center has not been formally evaluated for its eligibility for listing on the national register, but its status as a "Mission 66" structure makes it potentially eligible. A determination of its eligibility would be completed to guide the rehabilitation work on the building's interior. If it was found not to be eligible, there would be no effect. If it was found eligible, the rehabilitation proposed in this alternative would result in a long-term moderate beneficial effect.

Cumulative Effects. Before the Historic Preservation Act was passed in 1966, various mining and ranch structures on lands now in the national memorial were removed or neglected, but since the act was passed the memorial has identified historic structures and now works toward their preservation. Coronado National Forest plans to continue developing inventories to use in preserving and interpreting cultural resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to Coronado National Memorial's limited preservation efforts, could result in long-term negligible beneficial effects on the area's historic structures.

Conclusion. Research and resource documentation are improving the national memorial's ability to make informed management decisions. The ongoing efforts to identify and preserve historic structures would benefit these resources. The overall result would be a long-term negligible beneficial effect on the historic structures of the national memorial.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of resources or values related to historic structures would result from implementing alternative E.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the survey work and continuing preservation work of the national memorial under alternative E would have an effect that would not be adverse.

Ethnographic Resources

Analysis. New and upgraded trails and roads under alternative E would improve access to and within the national memorial, bringing visitors to previously little visited areas. Restoring natural contours and revegetating areas of powerlines and abandoned roads would not interfere with the ethnographic use of the memorial by American Indians. The long-term beneficial effects of alternative E on ethnographic resources would be negligible.

Cumulative Effects. Until recently, Coronado National Memorial has made no attempt to identify ethnographic resources; however, it is now in the process of identifying and protecting those resources. Coronado National Forest plans to protect ethnographic resources. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of the development; however, such growth might adversely affect ethnographic resources. The county has identified scenic corridors and conservation easement areas that could protect ethnographic resources. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, added to the actions of Coronado National Memorial under alternative E, would result in long-term negligible adverse effects on the area's ethnographic resources.

Conclusion. The possibility of adversely affecting ethnographic resources would be greater in alternative E than in some of the other alternatives because visitors would have more access to the grasslands in the national memorial. The actions of this alternative could have a long-term negligible adverse impact on ethnographic resources.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of ethnographic resources would result from implementing alternative E.

Cultural Landscapes

Analysis. Reestablishing natural contours and revegetating the areas of abandoned powerlines and roads could affect cultural landscapes, as could road and trail building and removing nonhistoric structures. However, because none of the roads, trails, or structures have been identified as being part of cultural landscapes, no effects on cultural landscapes would result from these actions.

With about 85% of the national memorial in the conservation prescription and 15 % in the education prescription, the views that represent the way the country looked to the Coronado Expedition would be perpetuated under alternative E. Even though the siting, design, and vegetative screening of the new facilities and roads would be done with care, vehicles on the roads and in the parking lots still could be visually intrusive from Montezuma Pass. The actions of alternative E would result in a negligible long-term adverse effect on cultural landscapes.

Cumulative Effects. Coronado National Memorial has recognized the importance of the CCC roadwork from the past and is now treating the Montezuma Pass road as a significant cultural landscape. Coronado National Forest plans to maintain and enhance visual resource integrity. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location, and type of development to reduce visual impacts. In addition, the county has identified scenic corridors and conservation easement areas. The Bureau of Land Management plans to protect and conserve cultural resources in the San Pedro Riparian National Conservation Area. These actions, along with NPS actions under alternative E (which could possibly have a beneficial effect on cultural landscapes) could result in long-term negligible beneficial effects on the area's cultural landscapes.

Conclusion. The possibility of adversely affecting cultural landscapes would be greater in this alternative than in some of the other action alternatives because of the variety of actions (constructing roads, facilities, and trails) that would take place. The actions of alternative E would result in a long-term negligible adverse impact on cultural landscapes.

Impairment. The resources and values of Coronado National Memorial would not be impaired because there would be no major adverse effects on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the national memorial, (2) key to the natural or cultural integrity of the memorial or to opportunities for visitor enjoyment, or (3) identified as a goal in this *General Management Plan* or other relevant NPS planning documents. Consequently, no impairment of cultural landscapes would result from implementing alternative E.

Section 106 Summary. Under the regulations of the Advisory Council on Historic Preservation (36 CFR 800.5) addressing the criteria of effect and adverse effect, the National Park Service finds that the actions of alternative E would not adversely affect cultural landscapes.

UNAVOIDABLE ADVERSE IMPACTS

The long-term adverse impacts on cultural resources that would result from accommodating visitors and their vehicles would be negligible.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The construction of facilities and other ground-disturbing activities could result in the loss of some archeological values through surface disturbance, inadvertent damage, or possible vandalism. This would vary slightly by site and by alternative.

RELATIONSHIPS OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Constructing trails, roads, and facilities for visitors and operations could result in slight short-term adverse effects on archeological or ethnographic resources or cultural landscapes, as could demolishing structures or revegetating areas. This would occur before and during construction or revegetation, when the site would be vulnerable to vandalism or other destructive activities. However, in the long term, completing these actions would save resources and enhance the preservation of the memorial's cultural resources. These long-term beneficial effects would occur in all the action alternatives, with the greatest effects in alternative B.

The various partnerships that would help to foster public appreciation and preservation of cultural resources, resulting in long-term minor to moderate beneficial effects. These beneficial effects would be greatest under alternatives B and D.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy requirements would increase with the construction of new structures. This would be mitigated by designing all structures to be energy-efficient. Alternatives D and E would require the most energy of all the alternatives because of the number of structures that would be maintained and used.

EFFECTS ON VISITOR UNDERSTANDING AND RECREATIONAL RESOURCES

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

Visitation to Coronado Cave nearly doubled between 1990 and 2000. Nearly 6 % of the people who visit Coronado National Memorial include exploring Coronado Cave in their visit. To protect cave resources, in all the action alternatives the national memorial would determine the cave's carrying capacity and restrict visitation when the limit was exceeded. Overall, setting limits on cave visitation would result in a negligible adverse impact on visitor understanding because only a small percentage of memorial visitors go to the cave. However, for people whose primary interest in the memorial is to visit the cave, setting a carrying capacity (with the potential that some visitors would not be allowed to use the cave when that capacity was reached) would result in a long-term moderate adverse effect.

Offering more intensive interpretation in the Montezuma Pass area would enhance visitor understanding and the visitor experience by offering opportunities to understand and appreciate the memorial's significant natural and cultural resources. Because visitors' use of the memorial's trails is minimal, this beneficial effect on visitor experience would be negligible to minor.

Developing interpretive media to support the national memorial's interpretive themes and focus on the memorial's mission, purpose, and significance would help to foster in visitors a greater appreciation of the memorial's resources. This would result in a minor to moderate beneficial effect on the visitor experience.

ALTERNATIVE A

Analysis

Access to Resources. The opportunity for visitors to experience the memorial's resources would be unchanged under alternative A, with most visitors spending one to two hours at the visitor center collections, the interpretive trail, the picnic area, and the Montezuma Pass overlook. Access for visitors with disabilities would be unchanged. Thus, visitors' ability to experience valuable resources would be limited, resulting in a negligible to minor adverse effect on the visitor experience.

Interpretation and Orientation. Continuing the existing displays of artifacts and paintings at the visitor center, wayside exhibits, and sales publications, as well as interpretive services such as self-guiding trails, volunteer interpretive programs, and occasional cultural demonstrations would be moderately important in conveying information to visitors and decreasing physical impacts on natural and cultural resources. Crowding at the visitor center would continue, adversely affecting the quality of the visitor experience. The long-term adverse effects on the visitor experience would be moderate.

Visitor Numbers and Recreation. If the overall use of the national memorial continued to increase, and if the proportion of visitors from outside the local area kept increasing, the visitor experience might eventually be affected unless there was a corresponding improvement in visitor services. Recreational use in the memorial would be adversely affected by the deterioration of the memorial's facilities and attractions from overuse, by the deferment of maintenance to divert funds to recreation-serving priorities, and by a possible decrease in long-term

visitation owing to the memorial's becoming less attractive as a recreation site.

Removing the Montezuma Ranch structures would make it possible to offer visitors an uninterrupted view of the San Pedro Valley from the Montezuma Peak scenic lookout. This would improve scenic values and result in a long-term minor to moderate beneficial effect on visitor understanding and the visitor experience.

Increasing visitor interest in exploring more of the memorial and complaints about the livestock in the grazing allotments indicate that reduced aesthetics and disturbed habitats degrade the visitor experience. With the local population growing and the demands for recreation and opportunities to observe wildlife and vegetation, increasing, continuing grazing would be likely to meet with more objections. Objections to continued grazing in this relatively small unit of the national park system also could come from people interested in having the memorial managed as a preserve for native plant and animal life in a region heavily used by the livestock industry. Therefore, continuing grazing would result in a long-term minor to moderate adverse impact on the visitor experience for those who would like to experience natural resources.

Cumulative Effects

Developments of various kinds outside the memorial boundaries in the United States and Mexico threaten to degrade the views from Montezuma Pass. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location and type of development to reduce visual impacts. In addition, the county has identified scenic corridors and conservation easements. Coronado National Forest plans to maintain and enhance visual resource integrity. Continued protection of the viewshed in the national memorial, combined with these activities, would result in beneficial effects on regional visitors.

Accessible campsites and interpretive facilities in Coronado National Forest offer recreational opportunities for mobility-impaired visitors. These facilities, along with other recreational opportunities in adjacent areas like state parks and the national conservation area, make it possible for visitors to experience the region's natural and cultural resources. These entities also offer orientation, visitor information, and other services to help acquaint the visitors with the area. Local chambers of commerce, private museums, and attractions also offer interpretation. These available regional recreational and interpretive resources would result in a moderate beneficial effect on visitor understanding in the region, and regional opportunities would help to offset the minor to moderate adverse impacts on the visitor experience that would result from alternative A.

Actions of the U.S. Immigration and Naturalization Service and the U.S. Border Patrol, along with Cochise County, to reduce illegal immigration and drug traffic along the smuggling route in the national memorial (such as fences along the international border) might reduce the potential for national memorial visitors to encounter smugglers, thereby enhancing visitor safety and the visitor experience.

Conclusion

Continuing the limitations on access to natural resources and cultural exhibits for mobility-impaired visitors along the memorial's trails would result in long-term negligible adverse impacts. If the demand for recreational resources continued to increase and no improvements were made, there would be local minor to moderate long-term adverse impacts on the visitor experience. Removing the Montezuma Ranch structures and restoring and revegetating the area would improve scenic values and the visitor experience from Montezuma Pass, resulting in a long-term minor beneficial effect on the visitor experience. Continued grazing in the

memorial would have a long-term negligible to minor adverse impact on visitors wanting to hike in the allotments.

ALTERNATIVE B

Analysis

Access to Resources. Developing four new trails and making two of them accessible for mobility-impaired visitors under alternative B would give visitors better access to natural resources and cultural exhibits. Ending grazing in the memorial would enable visitors to reach previously undervisited grassland habitats more easily, so that these areas would be more available for hiking and birding. The long-term benefits to visitor access would be negligible to minor because only a small percentage of the people who visit the memorial hike the trails.

Adding more parking spaces at the visitor center and parking spaces for buses and recreational vehicles would reduce congestion, as would adding more pullouts. The new pullouts also would afford easier and safer access to views of the national memorial resources. These actions would result in long-term minor to moderate beneficial effects on visitor understanding and the visitor experience, which would vary depending on the level of visitation.

Interpretation and Orientation. Expanding the visitor center and updating interpretive materials would reduce congestion and improve the memorial's ability to convey the story of Coronado National Memorial's natural and cultural resources, improving visitor understanding and the visitor experience. Offering more in-depth interpretation at the rehabilitated visitor center and at Montezuma Pass and adding interpretive media in other locations, along with events sponsored by the national memorial, would give more visitors an opportunity to appreciate and understand the story of the memorial. Working with other groups on interpretive programs and activities to support appreciation of the memorial's natural and cultural resources and improving interpretive materials would enhance the visitor experience. These actions would encourage increased participation in interpretation and educational programs, which would result in a moderate beneficial effect on the visitor experience.

Visitor Numbers and Recreation. As the actions in this alternative are implemented, visitation numbers could gradually increase to nearly 40,000 visitors per year. Developing a group picnic area would reduce congestion in the current picnic area, especially during high visitation times. There would be minor short-term adverse effects on recreation from construction activities (noise, area closures), but the enlarged facilities would accommodate larger numbers of visitors, helping to disperse them and reducing crowding, which would result in long-term minor to moderate beneficial effects on the visitor experience.

Removing the Montezuma Ranch structures and restoring and revegetating that area and East Forest Lane would enable visitors to enjoy an uninterrupted view of the San Pedro Valley from the Montezuma Peak scenic lookout, improving scenic values, a long-term minor to moderate beneficial effect.

Cumulative Effects

Various kinds of development in Mexico and the United States (outside the memorial boundaries) threaten to degrade the views from Montezuma Pass. Cochise County plans for increased growth in the southern San Pedro Valley, but with guidelines on the scale, density, location and type of development to reduce visual impacts. In addition, the county has identified scenic corridors and conservation easements. Coronado National Forest plans to maintain and enhance visual resource integrity. Continued protection of the viewshed in the memorial, combined with

these activities, would result in beneficial cumulative effects for visitors to the region.

Accessible campsites and interpretive facilities in Coronado National Forest offer recreational opportunities for mobility-impaired visitors. These facilities, along with other recreational opportunities in adjacent areas like state parks and the national conservation area, make it possible for visitors to experience the region's natural and cultural resources. These entities also offer orientation, visitor information, and other services to help acquaint the visitors with the area. Local chambers of commerce, private museums, and attractions also offer interpretation. These available regional recreational and interpretive resources would combine with increased recreational opportunities in the memorial under alternative B to result in cumulative beneficial effects on the visitor experience.

The potential for national memorial visitors to encounter smugglers might be reduced by actions taken by the U.S. Immigration and Naturalization Service, the U.S. Border Patrol, and Cochise County to reduce illegal immigration and drug traffic along the smuggling route (such as fences along the international border). This would enhance visitor safety and the visitor experience.

Conclusion

Improving recreational services and facilities in Coronado National Memorial would result in negligible to minor short-term and long-term beneficial effects on the visitor experience. The visitor experience also would be enhanced by resource conservation. Improving interpretive materials and expanding outreach programs that emphasize the memorial's mission, purpose, and significance would enhance the opportunities for visitors to learn about and understand the memorial's resources, a moderate long-term beneficial effect on the visitor experience.

Eliminating grazing would enable visitors to experience the natural resources of the grasslands, a negligible to minor beneficial effect on the visitor experience.

ALTERNATIVE C

Analysis

Access to Resources. Upgrading the trail at the visitor center and making it accessible to mobility-impaired visitors would enhance visitor access to natural exhibits. Ending grazing in the memorial might result in increased use of the allotment areas by visitors, but not developing new trails might restrict recreational activity compared to alternative B. These actions would result in negligible beneficial effects on the visitor experience. The beneficial effects from improving the visitor center trail would be negligible because the trail is small.

Developing more parking at the visitor center and adding parking for buses and recreational vehicles would reduce congestion. The beneficial effects of these actions on visitor understanding and the visitor experience would vary, depending on the level of visitation; they would be negligible to minor because the size of these developments in alternative C would be smaller than the changes in alternative B.

Interpretation and Orientation. Emphasizing work with other groups to tell the memorial's story and reach beyond the boundary would result in effects similar to those described for alternative B; however, because interpretation in the memorial would not be enhanced in alternative C, the benefits would be fewer. Only a minor beneficial effect on visitor understanding and the visitor experience would result from using outreach programs alone.

Visitor Numbers and Recreation. As the actions in this alternative are implemented, visitation numbers could gradually increase to nearly 40,000 visitors per year. The

recreational opportunities available under alternative C would be similar to those described for alternative A. Upgrading the interpretive trail at the visitor center would broaden opportunities, mainly for mobility-impaired visitors. Removing the Montezuma Ranch structures and restoring and revegetating the area would enable visitors to enjoy an uninterrupted view of the San Pedro Valley from the Montezuma Peak scenic lookout, improving scenic values, a long-term minor to moderate beneficial effect.

Cumulative Effects

The cumulative effects of alternative C on the visitor experience would be similar to those described for alternative A.

Conclusion

Under alternative C, access via memorial trails to natural resources and cultural exhibits for visitors with disabilities would continue to be limited, a negligible to minor adverse impact. Ending grazing in the memorial would enable some visitors to use grassland areas that have been little used for recreation; however, with no trails being developed in the allotment areas, the use would remain limited. Expanding the NPS facilities would result in short-term minor to moderate adverse impacts on the visitor experience, but in the long term there would be minor to moderate beneficial effects resulting from decreased congestion and improved views. Using outreach programs alone to emphasize the memorial's interpretive themes would result in only a minor beneficial effect on visitor understanding and the visitor experience.

ALTERNATIVE D

Analysis

Access to Resources. Eliminating grazing from the Montezuma allotment would enable people to visit grassland habitats that previously were little used by visitors. The beneficial effect on the visitor experience would be negligible to minor because only a small percentage of the people who visit the memorial hike the trails. Upgrading some trails for accessibility would result in negligible to minor beneficial effects for visitors with disabilities by improving their access to the memorial's natural and cultural resources.

Establishing a commemorative feature at the end of East Forest Lane would result in a major attraction, offering visitors an opportunity to understand and appreciate the Coronado Expedition and fostering international amity. Paving East Forest Lane for vehicle access to the new feature in an area previously restricted to vehicles would enable visitors to experience the natural resources of the grasslands. This development would result in a long-term moderate to major beneficial effect on the visitor experience.

Adding parking spaces at the visitor center and the picnic area and developing more pullouts and picnic sites would reduce congestion in these high use areas, and the new pullouts would make it easier and safer to reach areas where views can be seen. These developments would result in long-term minor to moderate beneficial effects on the visitor experience, which would vary depending on the level of visitation.

Interpretation and Orientation. Interpretive emphasis on the memorial's international themes at the visitor center, the educational center, and the border commemorative feature would result in moderate beneficial effects on visitor understanding and the visitor experience. Moderate beneficial effects also would result from NPS sponsorship of events at universities and in the memorial and from offering exhibits and interpretive programs at the visitor and educational center. NPS participation in increasing outreach educational programs also would result in moderate beneficial effects on visitor understanding and the visitor experience.

Visitor Numbers and Recreation. As the actions in this alternative are implemented, visitation numbers could gradually increase to nearly 40,000 visitors per year. Developing an educational center on the Montezuma Ranch site, combined with displaying and interpreting the national memorial's themes at the visitor center, would reduce congestion and improve the visitor experience. Congestion also would be reduced, especially at high visitation times, by the addition of a group picnic area.

Building roads and constructing facilities and trails would increase the possibility of adversely affecting the viewshed, but vegetative screening and design planning would mitigate adverse impacts on the visitor experience, so that the long-term adverse effects would be minor.

Noise from construction equipment and the temporary closure of some areas would result in short-term minor to moderate adverse effects on the visitor experience. After facilities were expanded, more visitors would be accommodated and crowding reduced, improving visitor understanding and the visitor experience, a moderate to major beneficial effect.

Cumulative Effects

The cumulative effects of alternative D on the visitor experience would be similar to those described for alternative A.

Conclusion

Under alternative D, access via memorial trails to natural resources and cultural exhibits for visitors with disabilities would increase, resulting a negligible to minor beneficial effect. Expanding the visitor center would result in short-term minor to moderate impacts on the visitor experience, but visitor congestion would decrease as a result of the added developments, resulting in long-term moderate to major beneficial effects on the visitor experience.

Improving interpretive materials and expanding the outreach programs that would emphasize the mission, purpose, and significance of the national memorial would enhance the opportunities for visitors to learn about and understand the memorial's resources, a moderate to major beneficial effect on the visitor experience. The new developments would affect the viewshed, resulting in long-term minor adverse impacts on the visitor experience. Eliminating grazing from the Montezuma allotment would benefit a small number of visitors who would use the trails in the grasslands, resulting in a negligible to minor beneficial effect on the visitor experience.

ALTERNATIVE E

Analysis

Access to Resources. Eliminating grazing from the Joe's Spring allotment would enable people to visit grassland habitats that previously were little used by visitors. The beneficial effect on visitor understanding and the visitor experience from closing the allotment to grazing would be negligible to minor because only a small percentage of the people who visit the memorial hike the trails. Likewise, developing three new trails in the grasslands would result in negligible to minor long-term beneficial effects on the visitor experience because only a small portion of visitors to the memorial use the trails.

Building a new visitor center north of the main road would make possible a panoramic view of the landscape and the valley, adding a major attraction that could offer visitors an opportunity to understand and appreciate the human and natural history of the memorial. Adding a paved road leading to the new visitor center would offer access to an area not previously accessible by vehicles, which would benefit most visitors, a long-term moderate to

major beneficial effect on visitor understanding and the visitor experience.

Adding more parking for buses and recreational vehicles would reduce congestion, resulting in negligible beneficial effects on the visitor experience, which would vary depending on the level of visitation.

Interpretation and Orientation. Emphasizing work with various groups to tell the national memorial's international stories and reach beyond the boundary would result in a minor beneficial effect on the visitor experience similar to that described for alternative C.

Visitor Numbers and Recreation. As the actions in this alternative are implemented, visitation numbers could gradually increase to nearly 40,000 visitors per year. Developing a visitor/educational center to display and interpret the national memorial's themes would accommodate more visitors and reduce congestion, improving the visitor experience, a long-term moderate to major beneficial effect. Designing the visitor center to blend into the environment and siting it so as to preserve the views from Montezuma Pass into the San Pedro Valley would minimize adverse effects on the viewshed, making the long-term adverse effects on recreation negligible. Removing the Montezuma Ranch structures and restoring and revegetating the area would enable visitors to enjoy an uninterrupted view of the San Pedro Valley from the Montezuma Peak scenic lookout, improving scenic values, a long-term minor to moderate beneficial effect on the visitor experience.

Cumulative Effects

The cumulative effects of alternative E on the visitor experience would be similar to those described for alternative A.

Conclusion

Under alternative E, access via memorial trails to natural resources and cultural exhibits for visitors with disabilities would increase, resulting in minor beneficial effects. The new, larger visitor/educational center would help to disperse visitors and alleviate congestion, a long-term moderate to major beneficial effect on visitor understanding and the visitor experience. Emphasizing the memorial's interpretive themes through outreach programs alone would result in a minor beneficial effect on the visitor experience.

The new developments that would affect the viewshed would result in long-term negligible adverse impacts on the visitor experience. Eliminating grazing from the Joe's Spring allotment would benefit a small number of visitors, a negligible to minor beneficial effect on the visitor experience.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There would not be any irreversible or irretrievable commitment of resources that would affect the visitor experience.

RELATIONSHIPS OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Constructing roads, trails, or visitor and operational facilities; demolishing structures, and revegetating areas could cause noise or the closure of areas in the short term, which would result in slight short-term adverse effects on the visitor experience. However, in the long term much of this work would conserve resources and enhance the preservation and interpretation of the memorial's resources, causing long-term beneficial effects. This would be true for all

alternatives, with the greatest effect brought about by alternative B.

Developing various partnerships would result in public appreciation and preservation of the memorial's resources, a long-term minor to moderate beneficial effect. Alternative B or D would result in the greatest of these benefits.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy requirements would increase with the construction of new structures. This would be mitigated by designing all structures to be energy-efficient. Alternatives D and E would require the most energy of all the alternatives because of the number of structures that would be maintained and used.

UNAVOIDABLE ADVERSE IMPACTS

The experience of recreational users under alternative A would be degraded over time as recreational use in the national memorial continued to increase without improvements in the quality and maintenance of visitor facilities and recreational opportunities. The visitor experience could be adversely affected by developing educational and visitor centers, trails, or roads in the viewshed, particularly the view from Montezuma Pass. These adverse effects would be negligible under alternatives D and E because the new facilities, roads, and trails would be designed to blend in with the natural landscape.

EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

ALTERNATIVE A

Recreational Use

Analysis. With few improvements in recreational facilities in the national memorial under alternative A, participation in recreational activities would increase at a rate approximately equal to the increases in visitation. Visitors would continue to hike, go to the visitor center, picnic, go birding, or go spelunking.

As the overall visitation to the national memorial increased, not adding improvements would lead to the deterioration of facilities and attractions through overuse and deferred maintenance as funds were diverted to recreation-serving priorities. This might cause a decrease in visitation as the memorial became a less appealing recreation site. This adverse long-term effect on recreational use would not be distinguishable from other factors that could cause changes in the number of visits or the amount spent per recreation visit. Therefore, it would have a negligible effect on both a countywide and local basis.

Cumulative Effects. Coronado National Forest serves local and regional recreational demand on lands adjacent to the memorial. As recreational use in the area continued to increase under the no-action alternative, the pressures on the national forest also would increase. Minor deterioration of the recreational experience in the national memorial might displace recreationists to the national forest, causing increased use of the forest. However, because federal lands with public access are widely available in Cochise County and throughout the state, this would have a negligible effect on recreational use.

Conclusion. Recreational use at the national memorial under alternative A would be relatively small in proportion to the total recreational demand and recreational opportunities both in Cochise County and throughout the Southwest. The effects of this alternative on recreational use would be negligible both locally and regionally.

Grazing

Analysis. Continuing grazing in the national memorial under alternative A would not result in any economic changes relating to grazing fees or cattle production. Because the number of cattle grazing in the memorial would not change, the economic effect of this alternative on grazing would be negligible.

Cumulative Effects. Cattle production in Cochise County has been declining in recent years, and the contribution of grazing to the local economy has likewise been diminishing. Implementing alternative A would not reduce grazing opportunities in the county and would not contribute to the cumulative effects of a reduction in local or regional grazing revenues.

Conclusion. The long-term effects of grazing on the socioeconomic environment under alternative A would be negligible.

Local and Regional Economy

Analysis. Coronado National Memorial contributes to the local and regional economy by employing people and by attracting visitors from the local area and from outside the region, including the entire United States and Mexico. Approximately 90,000 visitors to the memorial in 2000 spent about $l81.50 per person per day (1995 data), adding about $7.3 million to the local economy. This level of visitation generates about 47 local-area jobs. It also contributes to the local economy through the direct employment of 12 full-time equivalent positions at the memorial.

In the past 20 years, visitation at the memorial increased from 47,825 in 1981 to 89,523 in 2000, (an increase of 87%). For this socioeconomic analysis of alternative A, it was assumed that the increase has been linear throughout this period and that visitation will continue to increase at the same rate. Using this approach, visitation would increase by about 65% during the 15- to 20-year life of this *General Management Plan*. This would produce annual visitation of about 150,000 in the year 2017. The national memorial would have a staff of about 20 people, and about 78 local-area jobs would be generated by visitation. In 1995 dollars, increases in visitation would add about $5 million in sales to Cochise County. These changes would have a negligible effect on the county's economy. The increase in 38 jobs generated directly (7) and indirectly (31) by the memorial would represent less than 0.1% of the employment of the county in 2000. Likewise, $5 million in additional spending would represent only about 0.07% of sales in the county in 2000.

This no-action alternative would result in negligible adverse effects on community services such as schools, sewers, water, and police. The demand for these services related to increased visitation at the memorial would be readily accommodated in a county that grew by 20% in the past decade. Tax revenues from new jobs and from purchases from retail merchants and restaurants by additional visitors would offset the costs of the additional services.

NPS staff members often are trained in fighting wildland fires, and the memorial already cooperates with the U.S. Forest Service in fire protection. The addition of seven trained personnel at the memorial would result in a minor long-term beneficial effect on wildland fire control in the county.

Cumulative Effects. Under the no-action alternative, actions at the national memorial would have negligible effects on social services and the economy of nearby communities and the county.

Conclusion. New jobs and visitor spending associated with alternative A would have negligible effects on the economy. The ability to provide additional personnel trained in fighting wildland fires would be a minor long-term beneficial effect on the region.

ALTERNATIVE B

Recreational Use

Analysis. It is assumed that improved facilities and opportunities at Coronado National Memorial under alternative B would increase visitation in 2017 by 25%, compared to the no-action alternative (A). This would include visits to the memorial and visitor participation in offsite opportunities such as cultural festivals and regional ecosystem preservation activities. The socioeconomic effects of this level of recreation compared to the no-action alternative are shown in table 13.

Using this assumption, the national memorial and its outreach programs would lead to approximately 188,000 visits or recreation-days per year, compared to about 150,000 under the no-action alternative. The visitor service enhancements, resource conservation measures, and outreach programs included in alternative B would enable the memorial to handle this level of recreation without reducing the quality of recreation experienced by visitors. The ability to accommodate an additional 38,000 recreational visits per year compared to the no-action alternative would be a moderate long-term beneficial effect on recreation use in Cochise County.

TABLE 13: SOCIOECONOMIC EFFECTS OF THE ALTERNATIVES IN 2017

	Alternative				
Feature	**A**	**B**	**C**	**D**	**E**
Visitation increase compared to no-action alternative	—	25%	25%	50%	50%
Annual visitation	150,000	188,000	188,000	225,000	225,000
Memorial employment (FTE)	20	29.5	25	29.5	29.5
Indirect jobs from visitation (FTE)	78	98	98	117	117
Spending by visitors (1995 dollars)	$12.3 million	$15.4 million	$15.4 million	$18.4 million	$18.4 million
Grazing level (AUMs)	340	0	0	214	126
Implementation cost (2000 dollars)	—	$2 million	$1.6 million	$3.6 million	$4.7 million
Annual cost for labor and materials (first 5 years only)	—	$400,000	$320,000	$720,000	$940,000

Cumulative Effects. The national memorial's increased capacity to provide recreational opportunities would help accommodate some of the increased demand for recreation that is expected to occur in Cochise County and southern Arizona over the next 15 years. Because of the improvements from alternative B, visitation would not be limited to the extent that visitors would seek other recreation opportunities such as visits to the nearby Coronado National Forest. In addition, by educating more visitors to the values of the natural and human history of the area, alternative B would help reduce the effects of the increasing demand for recreation throughout the area. Cumulatively with other nearby recreation facilities, the actions of alternative B would result in minor long-term beneficial effects on recreational use in the area.

Conclusion. Alternative B, the preferred alternative, would result in moderate long-term beneficial effects on recreation by accommodating more recreation than alternative A.

Grazing

Analysis. Ending grazing in the Joe's Spring and Montezuma allotments would eliminate 340 AUMs of grazing capacity, which the ranchers would be unable to replace. However, this 340 AUMs of grazing capacity amounts to only a tiny portion of the forage needed to support the current livestock population of Cochise County (74,250–82,500 head of cattle). In addition, cattle production represents just a small part of the county's diverse economy. Although eliminating 340 animal unit months of grazing capacity would be an adverse effect on the individual ranchers affected, the economic effect both locally and on a countywide basis would be negligible.

Closing the grazing allotments would reduce conflicts between cattle and national memorial visitors and would facilitate the placement of recreational amenities in the parts of the memorial previously used for grazing. This would contribute to an overall increase in the memorial's ability to offer recreational opportunities, resulting in a minor beneficial effect on recreational use.

Grazing fees paid to the National Park Service represents a small percentage of the national memorial's annual operating budget. Therefore ending the payment of grazing fees to the National Park Service would be a negligible

adverse effect on the memorial's operating budget.

Cumulative Effects. A century ago, cattle production, along with mining, provided the economic foundation of Cochise County. However, the importance of cattle production has diminished as the human population has grown and other sources of income have been developed. Regardless of actions taken by the national memorial, rangelands will continue to be converted to other uses, cattle production in the county will continue to decline, and the percentage that ranching contributes to the county economy will diminish. Implementing alternative B would make a negligible contribution to this decline.

Conclusion. Ending grazing in the national memorial would result in a negligible adverse effect on the county's economy from reduced cattle production.

Local and Regional Economy

Analysis. If visitation to the national memorial increased 25% by 2017 under alternative B, compared to alternative A, annual spending by visitors would be about $15.4 million, or about $3 million more than visitor spending under alternative A. The memorial would have 9.5 more staff members and would indirectly produce 20 additional local area jobs compared to the no-action alternative. These changes, which would increase employment and sales in the county by less than 0.1% of the year 2000 values, would have a negligible beneficial effect on the economy of Cochise County. The demand for community services such as schools, sewers, water, and police would result in a negligible adverse effect compared to alternative A. Tax revenues from the new jobs and retail and restaurant purchases by the additional visitors would offset the costs of the added services.

The facility construction, rehabilitation, and revegetation called for by alternative B would involve costs of slightly more than $2 million for labor and materials. That amount would be spent over 15 years, with most of the construction taking place in the first 5 years. In addition, in the first 5 years about $400,000 per year would be spent for labor and materials. Most of these funds probably would be spent in Cochise County and the surrounding region. These expenditures, which would represent less than 0.1% of the county's year 2000 sales, would have a negligible short-term beneficial effect on the economy of Cochise County. Construction employment in Cochise County is approximately 1,200 (Arizona DES 2001). The construction activity required to implement alternative B would be within the capabilities of the local construction labor force.

Closing the grazing allotments in the national memorial would reduce grazing production by 340 AUMs per year. Currently a 6- to 8-month-old weaned calf sells for $250 (heifer) to $350 (steer) (Ax and Armer 1993). Grazing in the two allotments would produce approximately 50 such calves annually. The loss of this production capacity would result in a long-term negligible adverse effect on the county economy of about $12,500 to $17,500 (50 calves x cost per calf).

NPS staff members often are trained in fighting wildland fires, and the memorial already cooperates with the U.S. Forest Service in fire protection. The addition of nine trained personnel at the memorial compared to the no-action alternative would have a minor long-term beneficial effect on wildland fire control in the county.

Cumulative Effects. Cochise County has a diverse economy that employed about 38,000 people in 2000 and produced sales of about $700 million. The growing population of southern Arizona and national economic trends will drive socioeconomic conditions in the county, with little effect from the amount contributed by Coronado National Memorial. During the first five years, alternative B would add 10 to 12 jobs to the local economy,

compared to the no-action alternative. After the construction phase was completed, this number would drop to about 5 additional jobs. This would be a negligible beneficial effect when compared to the total employment in Cochise County.

Conclusion. Implementing alternative B would result in negligible beneficial effects on the economy of Cochise County compared to alternative A. These effects would result from the direct and indirect creation of local jobs, increased spending associated with more visitation, and expenditures on construction labor and supplies. Negligible adverse effects would result from decreased cattle production. The addition of NPS staff trained in wildland fire suppression would result in a minor long-term beneficial effect on wildland fire control in the county.

ALTERNATIVE C

Recreational Use

Analysis. Improved facilities and opportunities at Coronado National Memorial under alternative C would increase visitation in 2017 by 25%, compared to the no-action alternative (A). This would include visits to the memorial and visitor participation in offsite opportunities generated through outreach programs. The socioeconomic effects of this level of recreation compared to the no-action alternative are shown in table 13, page 221.

The effects on local and regional recreation from implementing alternative C would be similar to those described for alternative B. The visitor service enhancements, resource conservation measures, and outreach efforts included in alternative C would enable the memorial to manage this level of recreation without adverse effects on the quality of recreation experienced by visitors. The memorial's ability to accommodate more recreational use than in alternative A would produce a moderate long-term beneficial effect on recreation in Cochise County.

Cumulative Effects. The cumulative effects from alternative C would be similar to those described for alternative B.

Conclusion. Improvements in facilities and resource conservation brought about by implementing alternative C — increased recreation services, improved facilities, better controls, and enhanced visitor experience — would result in minor long-term beneficial effects on recreation.

Grazing

Analysis. Ending grazing in the two allotments in the memorial would result in the same effects as described for alternative B. Eliminating 340 AUMs of grazing capacity would adversely affect the individual ranchers who would lose that amount of grazing capacity, but the countywide economic effect would be negligible. Eliminating grazing on the memorial's allotments would contribute to an overall increase in the memorial's ability to offer recreational opportunities; however, since no new trails would be developed to facilitate visitor access into the grassland areas, the beneficial effect on recreational use would be negligible. The effect of ending the payment of grazing fees to the National Park Service would be similar to that described for alternative B and would have a negligible adverse effect on the memorial's operating budget.

Cumulative Effects. Eliminating grazing from the national memorial would slightly reduce the number of cattle raised annually in Cochise County. Although the individual ranchers would be adversely affected, the countywide economic effect from alternative C would be negligible.

Conclusion. Eliminating grazing in the national memorial would result in a negligible

long-term adverse effect on the county's economy from reduced cattle production.

Local and Regional Economy

Analysis. If visitation to the national memorial increased by 25% under alternative C by 2017, compared to the no-action alternative, annual spending by visitors would be about $15.4 million, or about $3 million more than visitor spending under alternative A. The memorial would have 5 more staff members and would indirectly produce 20 more local area jobs compared to alternative A. These changes, which would increase employment and sales in the county by less than 0.1% of the year 2000 values, would cause a negligible beneficial effect on the economy of Cochise County. The demand for community services such as schools, sewers, water, and police would result in a negligible adverse effect compared to alternative A. Tax revenues from the new jobs and from retail and restaurant purchases by the additional visitors would offset the costs of the additional services.

The facility construction, rehabilitation, and revegetation called for by alternative C would involve costs of $1.6 million for labor and materials. That amount would be spent over 15 years, with most of the construction taking place in the first 5 years. In addition, in the first 5 years about $320,000 per year would be spent for labor and materials. Most of these funds probably would be spent in Cochise County and the surrounding region. The level of construction brought about by alternative C would be within the capabilities of the local construction labor force. These expenditures, which would represent less than 0.1% of the county's year 2000 sales, would have a negligible short-term beneficial effect on the economy of Cochise County.

Closing the grazing allotments in the national memorial would reduce grazing production by 340 AUMs per year. This loss of production capacity would be similar to those described for alternative B and would result in a long-term negligible adverse effect on the county economy.

NPS staff members often are trained in fighting wildland fires, and the memorial already cooperates with the U.S. Forest Service in fire protection. The addition of five trained personnel at the memorial compared to the no-action alternative would have a minor long-term beneficial effect on wildland fire control in the county.

Cumulative Effects. During the first five years, alternative C would add 10 to 12 jobs to the local economy, compared to the no-action alternative. After the construction phase was completed, this number would drop to about 5 additional jobs. This would be a negligible beneficial effect when compared to the total employment in Cochise County.

Conclusion. Implementing alternative C would result in negligible beneficial effects on the economy of Cochise County compared to alternative A. These effects would result from the direct and indirect creation of local jobs, increased spending associated with increased visitation, and expenditures on construction labor and supplies. Negligible adverse effects would result from decreased cattle production. The addition of NPS staff trained in wildland fire suppression would result in a minor long-term beneficial effect on wildland fire control in the county.

ALTERNATIVE D

Recreational Use

Analysis. Improved opportunities and facilities added to the national memorial under alternative D (a new educational center, the commemorative feature) would increase visitation in 2017 by 50%, compared to the no-action alternative. This would include visits to the memorial and visitor participation in offsite opportunities such as Coronado-related events at various universities. The

socioeconomic effects of this level of recreation compared to alternative A are shown in table 13, page 221.

Using this assumption, the national memorial and its outreach programs would provide about 225,000 visits or recreation-days per year, compared to about 150,000 in alternative A. The enhanced visitor services, resource conservation measures, and outreach efforts included in alternative D would enable the memorial to accommodate this increased visitation without adverse effect to the quality of recreation experienced by visitors. The ability to accommodate the increased recreational use compared to the no-action alternative would result in a moderate long-term beneficial effect on recreation in Cochise County.

Cumulative Effects. The cumulative effects on recreational use from alternative D would be similar to those described for alternative A.

Conclusion. Implementing alternative D, which would involve more recreational opportunities than alternative A, would result in moderate long-term beneficial effects on recreational use.

Grazing

Analysis. Eliminating grazing from the Montezuma allotment would remove 126 AUMs of grazing capacity from the memorial, and the ranchers who would lose this grazing capacity would not be able to replace it. The 126 AUMs of grazing capacity is only a small portion of the grazing required to support the current livestock population of Cochise County (74,250–82,500 head of cattle). Although eliminating these AUMs would have an adverse effect on individual ranchers, the countywide adverse effect would be negligible. Eliminating grazing fees to the National Park Service for the Montezuma allotment would have a negligible adverse effect on the memorial's operating budget.

Ending grazing in the Montezuma allotment would reduce conflicts between visitors and cattle and enable the National Park Service to place recreational amenities south of the main road, including an educational center and a commemorative feature. This would allow the national memorial to offer more recreational opportunities, resulting in a minor beneficial effect on recreational use.

Cumulative Effects. Regardless of actions taken in the memorial, cattle production in the county would continue to decline, both in the number of cattle produced and its percentage of contribution to the county economy. Eliminating 126 AUMs under alternative D would make a negligible contribution to this decline.

Conclusion. Eliminating grazing from the Montezuma allotment would result in a minor long-term beneficial effect on recreational use and a negligible adverse effect on the county's economy from reduced cattle production.

Local and Regional Economy

Analysis. If visitation to the national memorial increased by 50% under alternative D by 2017, compared to the no-action alternative, annual spending by visitors would be about $18.4 million, or about $6 million more than visitor spending under alternative A. The memorial would have 10 more staff members and would indirectly produce 39 additional local area jobs compared to the no-action alternative. These changes, which would increase employment and sales in the county by less than 0.1% of the year 2000 values, would result in a negligible beneficial effect on the economy of Cochise County. The demand for community services such as schools, sewers, water, and police would result in a negligible adverse effect compared to alternative A. Tax revenues from the new jobs and retail and restaurant purchases by the additional visitors would offset the costs of the added services.

The facility construction, rehabilitation, and revegetation called for by alternative D would

involve costs of $3.6 million for labor and materials. That amount would be spent over 15 years, with most of the construction taking place in the first 5 years. In addition, in the first 5 years about $720,000 per year would be spent for labor and materials. Most of these funds probably would be spent in Cochise County and the surrounding region. The level of construction brought about by alternative D would be within the capabilities of the local construction labor force. These expenditures, which would represent less than 0.1% of the county's year 2000 sales, would have a negligible short-term beneficial effect on the economy of Cochise County.

Eliminating grazing from the Montezuma allotment would reduce grazing production by 126 AUMs per year. This loss of production capacity would result in a long-term negligible adverse effect on the county economy of about $4,500 to $6,300 (18 calves x cost per calf).

NPS staff members often are trained in fighting wildland fires, and the memorial already cooperates with the U.S. Forest Service in fire protection. The addition of ten trained personnel at the memorial compared to the no-action alternative would have a minor long-term beneficial effect on wildland fire control in the county.

Cumulative Effects. Cochise County has a diverse economy that employed about 38,000 people in 2000 and produced sales of about $700 million. The growing population of southern Arizona and national economic trends will drive socioeconomic conditions in the county, with little effect from the amount contributed by Coronado National Memorial. Alternative D would result in a negligible beneficial effect on the total economy of Cochise County.

Conclusion. Implementing alternative D would result in negligible beneficial effects on the economy of Cochise County compared to alternative A. These effects would result from the direct and indirect creation of local jobs, increased spending associated with more visitation, and expenditures on construction labor and supplies. Negligible adverse effects would result from decreased cattle production. The addition of NPS staff trained in wildland fire suppression would result in a minor long-term beneficial effect on wildland fire control in the county.

ALTERNATIVE E

Recreational Use

Analysis. Improved facilities such as the new visitor center and opportunities at Coronado National Memorial under alternative E would increase visitation in 2017 by 50%, compared to alternative A. This would include visits to the memorial and visitor participation in offsite opportunities. The socioeconomic effects of this level of recreation compared to alternative A are shown in table 13, page 221.

Using this assumption, the national memorial and its outreach programs would provide approximately 225,000 visits or recreation-days per year, compared to about 150,000 under the no-action alternative. The improved facilities, enhanced visitor services, resource conservation measures, and outreach programs that would be included in alternative E would enable the memorial to accommodate this increased visitation without reducing the quality of recreation experienced by visitors. The ability to accommodate the increased level of recreational use compared to the no-action alternative would cause a moderate long-term beneficial effect on recreation in Cochise County.

Cumulative Effects. The cumulative effects on recreational use from alternative E would be similar to those described for alternative A.

Conclusion. Alternative E would result in more recreation opportunities than would be available under alternative A; this would be a moderate long-term beneficial effect on recreational use.

Grazing

Analysis. Ending grazing in the Joe's Spring allotment would remove 214 AUMs of grazing capacity from the memorial, and the ranchers who would lose this grazing capacity would be unable to replace it. The 214 AUMs of grazing capacity is only a small portion of the grazing required to support the current livestock population of Cochise County (74,250–82,500 head of cattle). Although eliminating these AUMs would have an adverse effect on individual ranchers, the countywide effect would be negligible. Ending the payment of one allotment's grazing fees to the National Park Service would be a negligible adverse effect on the memorial's operating budget.

Eliminating grazing from the Joe's Spring allotment would reduce conflicts between visitors and cattle and would enable the National Park Service to place recreational amenities north of the main road, including a new visitor center. This would allow the national memorial to offer more recreational opportunities, resulting in a minor beneficial effect on recreational use.

Cumulative Effects. Regardless of actions taken in the memorial, cattle production in the county would continue to decline, both in the number of cattle produced and its percentage of contribution to the county economy. Eliminating 214 AUMs under alternative E would make a minor contribution to this decline.

Conclusion. Ending grazing in the Joe's Spring allotment would cause a minor long-term beneficial effect on recreational use and a negligible adverse effect on the county's economy from reduced cattle production.

Local and Regional Economy

Analysis. If visitation to the national memorial increased by 50% under alternative E by 2017, compared to the no-action alternative, annual spending by visitors would be about $18.4 million, or about $6 million more than visitor spending under alternative A. The memorial would have 10 more staff members and would indirectly produce 39 additional local area jobs compared to the no-action alternative. These changes, which would increase employment and sales in the county by less than 0.1% of the year 2000 values, would have a negligible beneficial effect on the economy of Cochise County. The demand for community services such as schools, sewers, water, and police would increase, resulting in a negligible adverse effect. Tax revenues from the new jobs and from retail and restaurant purchases by the added visitors would offset the costs of the additional services.

The facility construction, rehabilitation, and revegetation called for by alternative E would involve costs of $4.7 million for labor and materials. That amount would be spent over 15 years, with most of the construction taking place in the first 5 years. In addition, in the first 5 years about $940,000 per year would be spent for labor and materials. Most of these funds probably would be spent in Cochise County and the surrounding region. The level of construction in alternative E would be within the capabilities of the local construction labor force. These expenditures, which would represent less than 0.1% of the county's year 2000 sales, would have a negligible short-term beneficial effect on the economy of Cochise County.

Eliminating grazing from the Joe's Spring allotment would reduce grazing production by 214 AUMs per year. This loss of production capacity would result in a long-term negligible adverse effect on the county economy of about $8,000 to $11,200 (32 calves x cost per calf).

NPS staff members often are trained in fighting wildland fires, and the memorial already cooperates with the U.S. Forest Service in fire protection. The addition of ten trained personnel at the memorial compared to the no-action alternative would have a

minor long-term beneficial effect on wildland fire control in the county.

Cumulative Effects. Cochise County has a diverse economy that employed about 38,000 people in 2000 and produced sales of about $700 million. The growing population of southern Arizona and national economic trends will drive socioeconomic conditions in the county, with little effect from the amount contributed by Coronado National Memorial. Alternative E would result in a negligible beneficial effect on the total economy of Cochise County.

Conclusion. Implementing alternative E would result in negligible beneficial effects on Cochise County's economy compared to alternative A. These effects would result from the direct and indirect creation of local jobs, increased spending associated with increased visitation, and expenditures on construction labor and supplies. Negligible adverse effects would result from decreased cattle production. The addition of NPS staff trained in wildland fire suppression would result in a minor long-term beneficial effect on wildland fire control in the county.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Implementing alternative A would not result in any additional commitment of resources to new activities or programs other than those already underway. The funds that would be expended under alternatives B, C, D, and E for construction materials and for labor needed to construct facilities and operate the programs would be irreversibly and irretrievably committed. The resources committed would vary by alternative, with the greatest expenditures being made under alternatives D and E.

RELATIONSHIPS OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Constructing roads, trails, or visitor and operational facilities; demolishing structures, and revegetating areas could result in minor short-term adverse impacts on recreational use. However, in the long term facilities and programs would be enhanced, resulting in minor to moderate beneficial effects on recreation. Alternatives B and E would result in the most favorable overall net benefits.

Continuing recreational use and visitor activities without improvements at the memorial under alternative A would reduce the long-term productivity of the socioeconomic environment over the long term.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy requirements would increase with the construction of new structures. This would be mitigated by designing all structures to be energy-efficient. Alternatives D and E would require the most energy of all the alternatives because of the number of structures that would be maintained and used.

UNAVOIDABLE ADVERSE IMPACTS

The experience of recreational users under alternative A would be degraded over time as recreational use in the national memorial continued to increase without improvements in the quality and maintenance of visitor facilities and recreational opportunities. With increases in the local population and out-of-area visitation to the memorial, the conflicts between livestock and visitors would continue and worsen. Eventually this would lead to reduced socioeconomic benefits locally and regionally. Continued grazing under alternatives A, D, and E would result in minor long-term adverse effects on socioeconomic conditions related to recreation use.

Discontinuing grazing under alternatives B and C would result in the loss of grazing fees.